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CXXXV. No. 3499 DECEMBER 15, 1944 9d. WEEKLY

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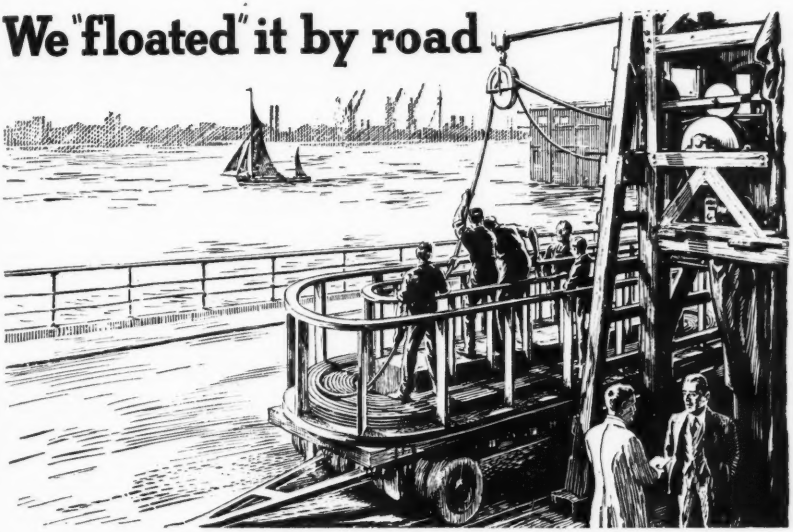

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ELECTRICAL REVIEW

December 15, 1944

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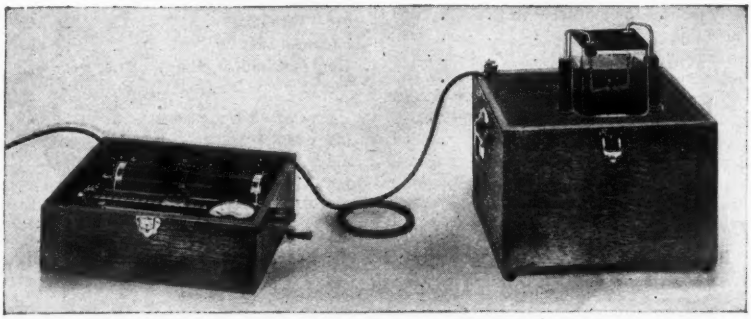

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXV. No. 3499. DECEMBER 15, 1944 9d. WEEKLY

An End to Compromise

Rediscovering Production Values

WHEREVER we look we can find evidence of wartime compromise, and after years of war there may be a tendency to take compromise for granted, and even mistake, from force of habit, some of our compromises for the real thing. Compromise is very necessary in wartime, but we should make sure that as restrictions in the use of materials are lifted we return to the use of the right materials in the right quantity and of the proper quality for every manufacturing purpose.

In manufacture it is not in materials alone that compromise has been introduced. The scarcity of skilled labour may in many cases have necessitated a change in processes which, whilst it is found to be necessary in emergency, is far from ideal.

Speeding-up Production

Again, the processes themselves may have been of such a character that speed of production has been a factor of such importance that ideal materials have had to give place to substitute materials which had only the merit of enabling faster production to be undertaken. If such high-speed production is no longer necessary for peace requirements, a possible return to the more suitable materials should not be overlooked.

This question of speed, too, is tied up directly with the quantity which it is required to produce. Peacetime production of some commodities will require more flexibility in the matter of changes of design and therefore tools and production planning for smaller quantities may be necessary.

A factor that cannot be left out of account in changing over to peace conditions is a possible and not unnatural reluctance to discard the fruits of discoveries and adaptations made during the war, which may not, however, possess the same value in different circumstances. The very success that has attended the efforts of scientists and engineers in developing new materials and applying them to urgent and specific problems may create a "vested interest" in their retention, especially if they offer apparent technical advantages.

Cost and Maintenance

An aspect that has to be considered is whether such technical advantages, developed under conditions in which cost was of minor importance, are enough to justify on commercial grounds the supersession of previously well-tried materials when these become fully available once more. Other points are whether products of this kind can be expected to give as high a performance with little maintenance over many years as they have for a relatively short useful life and whether they are in the direct line of foreseeable advance or merely lead up a blind alley. That is not to depreciate the value of these developments, but rather to suggest that many of them should be the subject of still further research both in the laboratory and under working conditions.

Although good short-term results have followed the imposition of a high degree of

standardisation with a view to extreme rapidity of production in unprecedented quantities, this cannot, as a long-term policy, take the place of standardisation by agreement, after due deliberation, without stunting progress or hampering initiative. How soon all compromise can be abandoned we cannot yet foresee, but it is time that we should begin to sort things out and rediscover some production values which wartime compromise has obscured.

Standard Alternators

IT was hardly surprising that Mr. G. A. Juhlin found himself constrained in his I.E.E. paper last week to return an adverse verdict on the feasibility of standardising designs for turbo-alternators. The pre-requisite of uniformity in users' requirements is still far to seek. Local conditions impose a diversity of practice in transmission and there are still differences of engineering opinion regarding power-station design that are far removed from those idiosyncracies that sometimes increase costs by calling for departures from well established standards without compelling reasons. Some of these differences will become less as certain principles become more generally accepted, *e.g.*, that system-voltage regulation will be transferred from busbars to transformers and that reactance for protecting switchgear and other apparatus against the effects of short circuits will be less concentrated in the alternator.

Why Standardise?

SINCE the main purpose of standardisation is to provide a better service (including lower prices) to the public over a term of years, a forward-looking policy needs to view expected advantages in relation to ultimate developments, as distinct from the securing of quick returns. It may well be in conflict with methods that have proved effective in the bulk manufacture of articles of the same kind—a description that would not fit the construction of alternators. Regarding mechanical interchangeability, the influence of the grid may be a relevant factor. A good case has been made for rotors to be interchangeable in the interests of reliability of supply, if these are likely to remain less dependable than other components of generating sets. Standardisation would also, as the President stated, facilitate export.

Further Consideration

ONE proposal that arises out of Mr. Juhlin's plan for closer collaboration between all interests involved in generating-plant construction seems likely to be implemented in the setting up of an authoritative committee to consider whether the difficulties he mentioned in the way of further standardisation can be overcome. Such a committee could be relied upon to be realistic in its outlook and could be trusted not to produce a "composite" design—a hybrid of the most sterile kind—and would, no doubt, actually encourage technical competition. It should be a standing committee in order that the critical point that may occur in each stage of development when standards cease to be beneficial shall not be passed without a review of the position. An example of such a critical point is to be found in the interrelation of outputs and speeds of turbo-alternators. All this is apart from the generally accepted principle of specifying performance in British Standards which enables tenders to be submitted on a common basis.

Reconversion of Industry

A SHORT time ago it was necessary to complain that little encouragement was being given to industrial concerns in their desire to prepare for their reversion to peacetime production. Now the picture seems to have changed so rapidly that the Board of Trade's anxiety to help is in advance of manufacturers' demands. At least that is what we deduce from the Minister of Production's statement in the House of Commons last week that the applications for facilities for the production of prototypes and samples "although numerous were disappointing." Mr. Lyttelton said that the Government, within the limits imposed by war needs, wanted to release the plants and the man-power which would make the largest contributions to export trade, the re-equipment of industry, the raising of the civilian standard of life, and the needs of the development areas.

Wartime Arrears

AN inkling of the magnitude of the task of catching up with arrears due to the war was given in a patent extension case last week. The invention in question was a safety cut-out for electric kettles and in the course of evidence it was

stated for the applicants (Bulpitt & Sons, Ltd.) that they had over 35,000 kettles and other heating appliances awaiting repair. No doubt other manufacturers are in a similar position and there are also thousands of out-of-action appliances in the hands of consumers despite the activities of electricity supply authorities' repair services. The wonder is that so much equipment has been kept going in the prevailing adverse conditions. Domestic appliance makers can look forward to full employment for a long time after the end of the war once labour and material become available.

Radiology

ALTHOUGH from the medical angle electricity cannot be truly credited with the sensational results sometimes claimed for it by unqualified practitioners, it has, of course, a steady record of service when administered by those possessing the requisite scientific background. How great are its potentialities in this connection is clear from the review of progress of industrial and medical radiology contributed to the November *I.E.E. Journal* by Dr. Bernard J. Leggett, who as an M.I.E.E. as well as a surgeon and physician is doubly qualified to deal with the subject. The greatest advance in radiology (which term covers electromagnetic radiation of all types) within the past decade he considers to be the discovery of the neutron and the use of the neutron beam, the full implications of which have yet to be worked out.

Explaining the Rules

SINCE regulations should preclude the possibility of legal interpretation in any other way than the one intended, meticulous and sometimes involved wording is necessary. This entails an effort on the part of a technical man in retranslating the meaning into an idiom with which he is more familiar. Hence the usefulness of such explanatory statements as the official memoranda on the Electricity Regulations applying to factories and to supply systems. A similar practice has been adopted in the United States, where a discussion of the National Electrical Safety Code has just been issued as National Bureau of Standards Handbook, H.39. It should greatly facilitate a ready understanding of Part 2 of the Code to which it relates which, published in 1941 as H.32, deals with the installation and maintenance of electricity supply and communication lines.

Joint Showrooms

ON previous occasions we have referred to the subject of the establishment of joint showrooms by electrical contractors. Moves have already been made in two or three cities and now we see that the Plymouth branch of the E.C.A. is taking action. It is reported that the necessary minimum capital is "easily in sight" and details of size and site have been discussed. A special company will be formed for the purpose, the title proposed being "Associated Electrical Contractors, Ltd." If electrical contractors are to secure the profitable appliance business they need to get together in this way. From such a beginning there is likely to spring a much closer co-operation in other directions which should lead to efficiency and greater public prestige.

London (Bomb) Transport

SOMETHING more than a spare-time job has been done by the London Passenger Transport Board during the past four years. In co-operation with four coachwork concerns it has been producing Halifax bombers—in fact several hundred of them—with a staff built up from very small beginnings and mostly with very little initial skill and knowledge. At the same time London Transport has continued its normal operations in an admirable fashion under very onerous conditions, and has thus rendered important service both to Londoners and to the United Nations. Perhaps it may be in order to hint that with this wartime experience there may be some speeding-up of London Transport after the war, although we do not anticipate Halifax buses.

E.D.A. Frivolities

HERE is another example of lay press sapience in electrical matters. Readers will have learned from a report in last week's *Electrical Review* that E.D.A. recently celebrated its silver jubilee at a dinner attended by many distinguished men, including members of the Government. The *Nottingham Journal* also reported the function: the heading given to the report was "Electricians at Play."

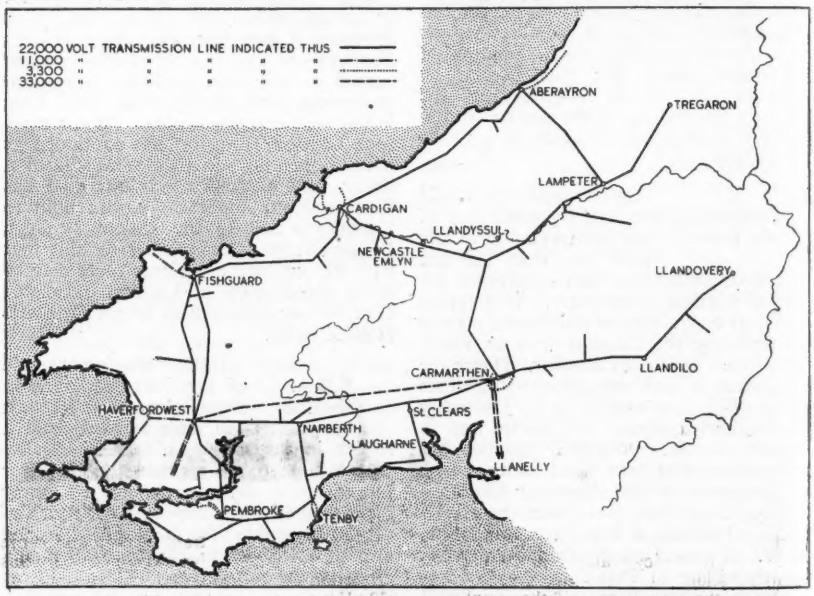
A Wholly Rural Area—I

Supply System of the West Cambrian and Associated Companies

IN contrast with the Birmingham rural area described in our issue of July 7th, the West Cambrian Power Co.'s undertaking has had to be planned without the slightest backing, or hope of backing, of an industrial load of any importance. The whole 1,900-sq. mile area served by the company and the associated Carmarthen Electric Supply Co., Ltd., and the Aberayron & District Electricity Supply & Power Co., Ltd. (all controlled by the Electric Development & Securities Trust, Ltd., which is itself a subsidiary of the General Electric Co., Ltd.), is almost entirely rural, and the largest town, Carmarthen, has a population of only 10,000.

With the exception of Milford Haven, Aberystwyth and Ysgubury Coed, and the few remaining non-statutory undertakings (2-wire DC) at St. Davids, Whitland, Laugharne, Llanstephen, Llangadock, New Quay and Clyderwen, the three companies between them cover the whole of Pembrokeshire, Cardiganshire and Carmarthenshire as far as the Llanelly and South Wales Power Cos.' boundaries. Apart from Carmarthen the only towns of any size are Haverfordwest, Tenby, Pembroke Dock, Pembroke, Cardigan, Fishguard, Lampeter and Newcastle Emlyn. As the total population is 176,100 the average per sq. mile is only ninety-three.

When the West Cambrian Power Co. commenced operations in 1929 it was a non-statutory undertaking supplying Fishguard. Following the granting of the South Wales Electricity Special Order in 1933, however, the company proceeded to shut down the small generating stations of the statutory and non-statutory concerns acquired, changing over their distribution systems from DC to AC and constructing a comprehensive h.v. network. As an indication of the progress made towards securing uniformity it is of interest to note that in 1933 the company was operating fifteen generating stations, Diesel, producer-gas, water turbine and reciprocating steam. Of these, thirteen were DC only, one AC only and one AC and DC. Now the only generating stations remaining in operation are at Haverfordwest, Lampeter and Llandyssul, and of these the first and second are used mainly as peak load and standby plants, the main supply (about 80 per cent. of the total) now being taken from the grid at 33 kV through the Llanelly & District Electricity Supply Co.'s substation at Trevaughan, just outside Carmarthen.



Transmission and distribution network of the West Cambrian Power Co. and its associated companies

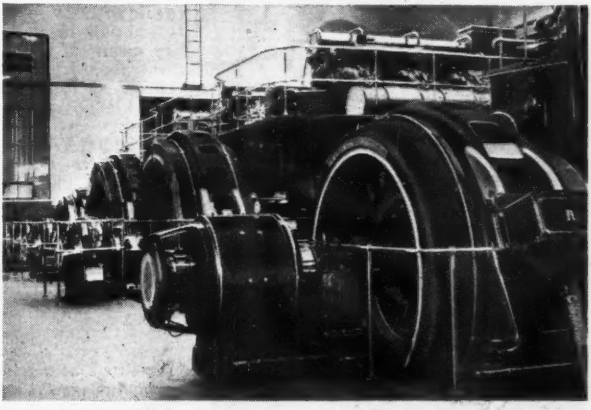
The generating plant at Haverfordwest is Diesel-engine driven and, with a total capacity of 4,500 kW, comprises four units each

Switchroom at Haverfordwest power station

rated at 1,000 kW and one at 500 kW. Two of the larger machines are Fraser & Chalmers 6-cylinder, 4-stroke units, while the other two are Atlas 8-cylinder, 2-stroke. The 500-kW machine is a 3-cylinder, 4-stroke Fraser & Chalmers unit. All of the sets generate at 11 kV. At Lampeter there are two 100-kW and one 200-kW, DC Diesel sets, two in the centre of the town and the other on the outskirts. These are of sufficient capacity to handle the local load and they run in conjunction with motor-generators which are normally used reversed to convert supplies from the h.v. AC network for DC distribution in the town. In addition to an 80-kW Diesel DC plant there is at Llandyssul a hydro-electric plant, completed in 1925, which comprises two ordinary turbines giving 35 kW each under the head of 20 ft. and a flood turbine giving about 18 kW with a 15 ft. head. A Diesel emergency plant of 80 kW capacity is also available at Aberayron.

By far the greater part of the supplies to the area is provided at the standard 400/230 V, 3 phase, 4 wire, but in some of the more remote districts only single-phase, 3-wire 460/230-V supplies are available, while DC remains in some districts where old systems were taken over by the company. Carmarthen still has a 460/230-V 3-wire supply and 230-V, 2-wire systems serve Lampeter, Llandyssul and part of Aberayron. A good deal of change-over work has already been carried out and its completion holds a place of high priority in the company's post-war plans.

In view of the comparatively large distances to be covered and the predominantly rural characteristics of the anticipated load, the h.v. network has some rather unusual features of design. Instead of a 6- or 11-kV system now generally favoured for rural work 22 kV has been adopted for the greater part of the area, 375 miles out of a total of 482 miles being at this voltage. Against the reduction in transmission losses through the use of this higher voltage must, however, be placed the necessity for larger transformers and more elaborate and expensive switchgear. To this objection may be traced the reason why 33 kV is not used for the general h.v. network;

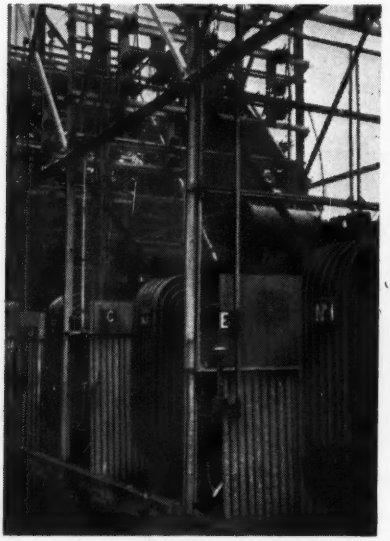


Some of the Diesel-engine generating plant at Haverfordwest

this voltage has, however, been adopted for a 29-mile-long trunk interconnector between Carmarthen and Haverfordwest. Due to salt deposits all the h.v. lines within five miles of the coast are over-insulated, while line stays and strain discs are provided to minimise gale damage. Of the remaining 107 miles of h.v. lines which form subsidiary networks 49 miles are of 11 kV and 38 miles of 3·3 kV. All but 41 miles of the total of 482 are overhead, the mileage for the l.v. lines being 134 overhead and 32 underground.

Thanks to careful siting of the lines the greater part of the area is now covered by a system of three h.v. ring mains, from which the more isolated areas are fed. The first runs from Carmarthen through Narberth to Haverfordwest, Fishguard, Cardigan and back to Carmarthen. As a secondary to this, another ring runs from Haverfordwest, through Pembroke, Tenby, Narberth and back to Haverfordwest, while Cardigan—Aberayron—Lampeter—Newcastle Emlyn—Cardigan is the route of the third. With the foregoing points in mind it is now possible to consider the system in greater detail.

Llandyssul hydro-electric station



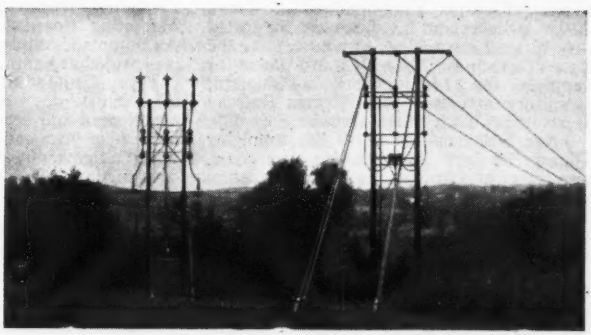
These 3·3/22-kV step-up transformers at Carmarthen substation feed the main h.v. network

As already mentioned, a bulk supply from the grid is taken from Llanelly at 33 kV through the Llanelly Company's Trevaughan switching station. Some of this supply is passed on at the same voltage direct to Haverfordwest by a single-circuit line terminating at Haverfordwest on to 4,000-kVA 33/22-kV transformers with on-load tap changing. The balance of the bulk supply from Llanelly is stepped down to 3·3 kV for local distribution in Carmarthen and up again to 22 kV for transmission over the West Cambrian network, control being effected by means of a 3·3 kV 13-panel truck type switchboard. The five step-up transformers employed (one 500-kVA serving Llandilo and Llandovery—there is a 3·3-kV system at Llandilo, two 1,150-kVA for Cardigan and two 1,150-kVA for Narberth) are not banked, but (under normal conditions) are considered as part of the lines they energise.

This has made it possible to fit definite minimum time element relays on the 3·3-kV switches controlling the transformers, these relays being energised from current transformers inserted in the earth connection of the star point on the 22-kV sides of the transformers and so serving as earth-leakage protection on the 22-kV lines. The transformers on the Narberth and Cardigan lines are fitted with remote control on-load tap-changing gear, interlocked so that it is impossible to run the transformers in parallel on different tappings.

The first ring main mentioned (Carmarthen—Haverfordwest—Cardigan—Carmarthen) is tapped between Carmarthen and Narberth to serve St. Clears and the Coygen quarries, where a 250-kVA transformer has been

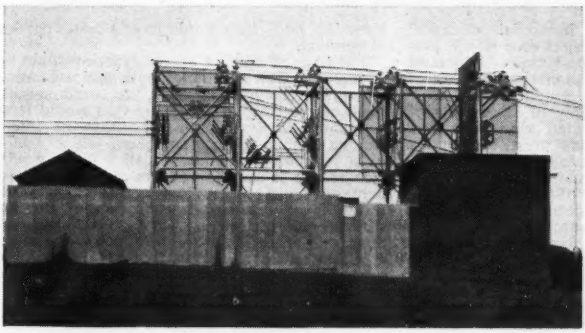
installed to give a supply, including heating tar for road metalling. The Narberth substation contains a 3-panel vertical isolating type board, which controls not only the 22-kV lines from Carmarthen and Haverfordwest but also a portion of the secondary ring-main system mentioned, the lines from Narberth to Golden Hill (Pembroke) *via* Broadfield, near Tenby. In another section of this substation, transformers for the local supply have their 22-kV sides controlled by air-break switchgear and fuses installed indoors. As in the case of similar supplies in the area, the l.v. network is controlled through pillar type units equipped with porcelain hand-guard fuses.



Left: 33-kV trunk line from Carmarthen to Haverfordwest fitted with lightning arrestors. Right: Carmarthen—Cardigan 22-kV line

At Broadfield a steel switching structure controls the line from Narberth and on to Golden Hill, and also the 22/3·3-kV transformers supplying a secondary h.v. network covering the Tenby and Saundersfoot districts. Industrial type switchgear is used for this secondary h.v. system. A hand-controlled booster of 600-kVA capacity giving a 10 per cent. boost is inserted in one of the 3·3-kV lines to Tenby. The switching structure at Golden Hill is of the same type as that at Broadfield. A 3·3-kV system radiating from it feeds Pembroke and Pembroke Dock and one of the feeders to the latter place has an automatic voltage regulator of 1,000-kVA capacity. In these two places the general supplies are given from kiosk substations. A special supply is furnished for the local sewage disposal scheme. Between Golden Hill and Haverfordwest the 22-kV circuit, which completes the second ring, crosses Milford Haven by a submarine cable supplied and installed by the Pirelli-General Cable Works, Ltd. Three miles from Haverfordwest there is another tapping to supply Hook Anthracite Collieries.

At Haverfordwest power station a 14-panel truck type board, besides controlling generating plant, also controls duplicate 11-kV feeders to Milford Haven, an 11-kV supply to the Haverfordwest area and the 11-kV side of 11/22-kV transformers (situated in an outdoor substation within the power station grounds) which feed into the main 22-kV network. The 22-kV side of these transformers and also the 22-kV feeders radiating from Haverfordwest are controlled by a 9-panel vertical isolating type board. Overload inverse-time element relays are fitted to both the transformer switches and the feeder switches, the latter having definite minimum time leakage relays as well. The 33-kV supply from Carmarthen is reduced to 22-kV by means of two 4,000-kVA transformers with remote on-load tap-changing and switches for neutral point earthing. The 11-kV supply from Haverfordwest to the Milford Haven U.D.C. is given by means of a double-circuit 0·075-sq. in. copper line on single poles.



Cardigan switching station

From Haverfordwest all the four single-pole, single-circuit 22-kV lines radiating to

Fishguard (two), Narberth and Golden Hill utilise the Pirelli-General patent pole-top fitting and have composite or cadmium copper conductors which have a copper equivalent of 0·035 sq. in. The conductors are carried on pin-type insulators, which, on the Fishguard and Golden Hill lines, are porcelain and on the Narberth line " Pyrex." The average span length is 375 ft.

At Fishguard gang-operated air-break 22-kV switches and h.v. fuses are supported on a steel switching structure, at the base of which are 22/11-kV transformers for supplying the 11-kV network in Fishguard, Goodwick and the Great Western Railway Harbour for the Irish Sea traffic.

From Fishguard the 22-kV line supplying Dinas, Newport (Pembrokeshire) *en route*, terminates at Cardigan in a steel structure similar to that at Fishguard. A secondary 3·3-kV system supplies the Cardigan districts, a 620-kVA oil-immersed booster transformer keeping up the pressure on the incoming supply from the Carmarthen-Cardigan line.

Forming part of the third ring-main system (Cardigan — Aberayron — Lampeter — Newcastle Emlyn—Cardigan), a 22-kV line runs northward from Cardigan to Aberayron, a single-phase line using hemp-cored 7/12 SWG steel conductors on " Pyrex " pin insulators being tapped off for supply to Llangranog. Two 250-kVA, 22/3·3-kV transformers serve Aberayron and the neighbouring villages of Aberarth and Llanon, and the 22-kV system continues south-east to Lampeter. The Cardigan—Carmarthen line passes through the Rhos switching station, Velindre (where there are woollen mills) and Newcastle Emlyn where there is a creamery. The Rhos switching structure is the tapping point for the line to Llanybyther, Lampeter and Tregaron. Tappings off the Rhos—Lampeter line supply Pencader and Llanybyther. The Lampeter—Tregaron line serves the Milk Marketing Board's Factory at Pontllanio. An automatic voltage regulator (1,000 kVA) is provided at Lampeter.

Throughout the area a considerable amount of trouble due to lightning has been experienced and a number of arrestors is in use. Like practically all the switchgear and other equipment installed, these are of G.E.C. construction. The cables, which are paper-insulated, lead-covered and double-steel-armoured, are all of Pirelli make. The usual sizes are: 22 kV: 0·04 sq. in./3-core. 11 kV and 3·3 kV: 0·0225 sq. in./3-core, 0·04 sq. in./3-core and 0·06 sq. in./3-core. Low-voltage (400/230 V): 0·06 sq. in./4-core, 0·1 sq. in./4-core and 0·25 sq. in./4-core. The low-voltage overhead system is normally carried on wood poles which support 0·05 sq. in. or 0·1 sq. in. copper conductors with an 8 SWG conductor for street lighting purposes.

In the next article we propose to describe the commercial aspects of the undertaking and the extent to which the facilities offered are already being utilised.

Organised Maintenance

Code of Practice Advocated

THE organisation of industrial electrical maintenance is the subject of a paper prepared by MR. J. C. B. NICOL (Imperial Chemical Industries, Ltd.) for the Installations Section of the Institution of Electrical Engineers.

The paper consists mainly of statements of principles, in part illustrated with examples, which the author contends must be applied systematically if the work is to be done efficiently. It is not economic to allow maintenance to resolve itself merely into the repair of faults and replacement of worn parts. There are many plants in which considerable returns are to be reaped from a small expenditure on planned maintenance which would forestall incipient faults. But workmen cannot be expected to plan well on their own; it must be conceived and controlled by the management. The paper defines a typical plan with illustrations of how instruction books and record cards should be properly kept.

The author suggests that B.S. specifications should be prepared for equipment data records; maintenance engineers would probably find it worth while to forgo their individual whims in order to obtain essential information promptly. If maintenance instructions, connection wiring diagrams and lists of spare parts, which manufacturers often issue, could all be provided on standard-size pages for binding into a strong loose-leaf book they would have a better chance of survival.

The issue of a B.S. Code of Practice would be advantageous; it should not make comprehensive technical recommendations, but could specify good administrative procedure that would tend to standardise systems and facilitate the interchange of maintenance engineers, which would be a refreshing practice. Such a Code would also render it easy for buyers of new plant to demand from consultants and erecting contractors all the information needed for instituting a proper system of maintenance. Standardisation of the kind outlined is proposed as a desirable positive step towards the ultimate goal of complete co-ordination.

Planning Road Transport

" Towards Ideal Transport " is the title of a booklet by C. R. Bizeray published by the Light Railway Transport League, 245, Cricklewood Broadway, N.W.2, to point out the advantages of light railways and tramways in the replanning of public transport services. Maximum possible speed, safety, reliability, regularity, comfort and low operating costs are among the outstanding features mentioned.

Electricity Supply Unification

Influence on Price per kWh

By J. L. Ferns, B.Sc., A.M.I.E.E., A.M.I.I.A.

STUDYING the nine major reports on electricity supply, from the Williamson to the final I.M.E.A. Report, one is forcibly reminded of the old quip regarding Hamlet without the Prince of Denmark, because not one of them contains any factual enlightenment on the paramount issue of reducing the cost of electricity.

It seems incredible that a report on the future of a £600,000,000 business could be presented to an executive body without any explanation as to the probable course of events in relation to the cost of the product. Definite proposals are put forward here to give constructive shape to the financial statements, but the reader is asked to dwell on the method of approach rather than on the details. The point is that whilst different engineers would make different proposals, every M.P. and every layman would want to know the influence of a scheme on the price per kWh before voting on it.

The main interest of the public in any scheme for the rationalisation of the electricity supply industry is its effect on the retail price of the commodity. The author seeks to fill the gap in published reports on reorganisation proposals by analysing the financial implications of unified control

Unless a unification scheme could effect considerable economies it clearly could not be carried out without great difficulty. Thus the first landmark to establish is the minimum annual saving which would make such a scheme practicable. By the application of simple—if tedious—mathematics to the returns for every undertaking it becomes evident that the saving must be of the order of £9,000,000 per annum if the charges in any undertaking are not to exceed the mean national level and the consumers enjoying low charges at present are not to be penalised. This sum is approximately 10 per cent. of the annual turnover of £92,000,000.

The second landmark is that unification of the industry implies single control or ownership, which automatically means that all electricity supply companies would have to be purchased, since the only single control or ownership envisaged by Parliament is that of the public.

The cost of purchasing the companies can be determined, on the "then value" basis laid down in Section 2 of the 1888 Act, to amount to not more than the face value of the capital raised, *viz.*, £172,000,000. The principal factor is the application of depreciation to the total capital outlay of £223,000,000 on the basis of the Scale of Depreciation (Purchase of Electricity Undertakings) Special Order, 1937. Overall depreciation amounted in 1938 to about 45 per cent., that is, a matter of £100,000,000, indicating that the other elements in favour of the companies have not been lightly assessed in order to arrive at the "then value" of £172,000,000. To the then value, however, must be added a compensation payment, which is the capitalised value of the loss of profits for the unexpired period of each franchise. In the case of the power companies the unexpired period of the franchise is taken to be fifty years, not infinity—which seems a reasonable compromise. This capitalised value works out at £96,000,000 using the modern interest rate of 3 per cent. Thus the cost of buying out the companies would amount to £268 million, on which the annual charges, based on 3 per cent. and a thirty-year period, amount to £13,650,000.

Although the purchase of the various types of existing publicly owned bodies has not to be considered, an allowance of £100,000 per annum must be made to cover the cost of certain severance claims, as the new organisation would no doubt be limited to electrical matters. Having established these two landmarks we can now fill in a little of the intervening scenery with the aid of Tables 23, 27 and 36 of the Commissioners' Returns.

Savings Envisaged

The principle of rate relief is widely held to be wrong and would, no doubt, be abolished by the new organisation, but gradually so as to avoid too sudden a strain on the rates affected. The sum to be eliminated is £585,352.

In view of the widespread character of the new organisation, allocations to reserves serve no further vital purpose and could be done away with, particularly as there is a hidden reserve of about £4,000,000 in the annual appropriations from revenue in aid of capital expenditure which could be employed for tiding over any temporary difficulties. The saving due to eliminating reserve allocations would amount to about

Figures quoted in this article are based on the Electricity Commission's Returns of Engineering and Financial Statistics for 1937-38 and rounded off.

£1,500,000 per annum. (To put the matter another way, is there any need to enlarge the present reserves *in toto* ?)

The new organisation would presumably be relieved of any income tax liability since it would be a non-profit-making public body, making a further saving of £1,695,000 per annum. This loss to the Exchequer would be offset by the reductions in the cost of electricity of which the Government is a large purchaser.

Costs of distribution and management for local authorities and companies for 1938 were £15 million, but rationalisation should reduce them over a period of time to £13 million, based on typical costs obtaining in existing well-run undertakings of a size comparable to that which would be set up by the new organisation. Against this saving must be offset the head-office costs of the new organisation and allowance must be made for failure to attain the ideal in the three-year period specified later, so that the net saving would probably be reduced to £1,000,000, assuming the continuance of present methods and making no allowance for any savings obtainable through rationalisation apart from changes in distribution areas. A saving of 10 per cent., amounting to £250,000 per annum, could no doubt rapidly be made in the cost of repairs and maintenance of meters, apparatus and wiring, chiefly through the elimination of small meter-testing and apparatus-repair depots.

MODIFIED TABLE 36. SURPLUS AND APPROPRIATION THEREOF (FIGURES IN £ MILLION)

ITEMS	1937-38	1946	1947	1948
Revenue from working ..	91·9	90·5	87·0	85·0
Less working expenses ..	49·2	49·4	48·5	47·8
Surplus	42·7	41·1	38·5	37·2
Interest, etc., from investments	1·8	0·8	0·8	0·8
Miscellaneous income ..	1·4	1·4	1·4	1·4
Gross surplus	45·9	43·3	40·7	39·4
Appropriation				
Public authorities:—				
Interest charges (gross)	6·5	6·5	6·5	6·5
Income tax	1·5	—	—	—
Loan repayments, sinking funds, reserve renewals and special expenditure	15·6	14·6	14·6	14·6
Severance compensation	—	0·1	0·1	0·1
Rate relief	0·6	0·4	0·2	—
Companies:—				
Interest and dividends	10·6	—	—	—
Depreciation and reserve and appropriation accounts	8·3	—	—	—
Loan charges in lieu of above	—	13·7	13·7	13·7
Expenditure to replace portion of depreciation, etc.	—	2·0	2·0	2·0
Income tax	0·2	—	—	—
Make-up for C.E.B. appropriations ..	2·2	2·2	2·2	2·2
Overall balance for year	0·4	3·8	1·4	0·3
TOTAL ..	45·9	43·3	40·7	39·4
Previous yrs. blnce. b/f..		0·1	3·9	5·3
FINAL BALANCE AVAILABLE		3·9	5·3	5·6

The effects of the above changes can be demonstrated by constructing modified Tables 23, 27 and 36 showing financial progress over the three years, 1946–48, after the date of purchase of the companies. In drawing a comparison a stationary state of the industry is assumed so as to keep all the figures comparable, although expansion could be expected at an even greater rate than before.

Revenue and Working Expenses

In the modified Table 36 here given for the purpose of illustrating the method described, Total Revenue from Working in 1946 has been taken at £90·5 million compared with £91·9 million in 1937-8, owing to assumed reductions in charges to consumers, other revenue items remaining the same. In 1947 a further reduction of £2·6 million has been allowed—£300,000 off meter rent, etc., the rest as a result of lower charges. By the following year the total revenue from working has fallen to £85 million in view of another cut of £300,000 from meter rents, etc., and another reduction in charges to consumers.

Working expenses in 1946 have been assumed to remain at approximately the same level as in 1937-38, *viz.*, £49·4 million. In the following years the most important alterations would be £400,000 and £600,000 less for transmission, distribution and management and £150,000 and £100,000 less for repairs of meters, etc., giving totals of £48·5 million for 1947 and £47·8 million for 1948, other items remaining approximately constant throughout the three-year period.

Under the heading " gross surplus " the revenue from interest and dividends would show an immediate fall after reorganisation, owing to the termination of interflow of these earnings between companies.

Appropriations

Certain items of company appropriations in Table 36 are replaced by others due to the change in method of finance. The origin of the loan charge figure of £13,650,000 has already been explained. The sum of £2,000,000 is introduced to keep the appropriations on a par with those for local authorities. The official Table 36 is not segregated suitably for present purposes, so after altering the previous items it was necessary to introduce the two special items of " make-up " for C.E.B. appropriations and " overall balance," in order to make the totals agree. The new organisation would still have to carry the costs of the C.E.B., so no change in this

respect is anticipated, since no lowering of the working costs of the C.E.B. is budgeted for. The overall balance replaces the previous itemised balances since we are now concerned with only one organisation.

The annual economy to the consumer effected by the third year has reached the presentable total of approximately £7,000,000, but not the target figure of £9,000,000. On the other hand a final balance of £5,600,000 has accumulated and in the light of the following points the new management should find it easy to attain the target.

(1) Considerable improvement in sales can justifiably be expected by reason of the large reductions in the cost of electricity; this improvement would enhance the efficiency of distribution and thus improve the gross surplus.

(2) Although all claims which are debatable have been avoided, mention should be made of the estimated value of savings owing to rationalisation, which would amount to at least £2,000,000 per year.

(3) The lapse of time since 1938 is in favour of the new organisation owing to the reduction in franchise periods and the increase in the total depreciation percentage, the value of which together should be at least £1,500,000 per year.

(4) No claim has been advanced as regards economies in the generation of electricity resulting from rationalisation.

By the presentation of the foregoing table the author feels justified in claiming the return of the Prince of Denmark to his part in the play. Even though the reader may alter the details making up the modified table, it must be agreed that the inclusion of some such method of demonstrating the effectiveness of a reorganisation scheme would have greatly enhanced the value of the reports referred to in the opening paragraph.

Radio Interference

Legal Powers Considered Necessary for its Suppression

SOME aspects of radio-interference suppression after the war were discussed at a meeting in London last month of the Radio Section of the Institution of Electrical Engineers.

MR. P. R. COURSEY opened the debate by explaining that the pre-war frequency range which had been catered for extended up to 1,500 kc/s, so that only the broadcast sound band had been covered and television viewers had to tolerate a certain amount of interference against which they had no remedy. It would become desirable to improve the six existing B.S.S. by modifying them, first, to extend the frequency range up to 600 Mc/s in order to protect television transmission and short-wave radio reception as well as the newer "radar" types of aid to civil aviation and marine navigation. There was also likely to be a considerable extension of the uses of high-frequency equipment in many industrial electronic applications, apart from the wider employment of high-power electro-medical apparatus, much of which was a source of troublesome interference. Alternatives to complete screening would have to be explored in future and it would be essential for radio receiver designers and manufacturers to pay close attention to such a potential source of trouble as superheterodyne sets, which could radiate over a very wide area.

The suggested 40 db degree of suppression might not always be practicable while suppression measures taken in other countries, which had hitherto only slightly affected radio manufacturers, might become very important in future. A high degree of uniformity would be most desirable, not only to assist the manufacturer of apparatus for export, but also to protect the listener who might purchase imported radio receivers or other electrical apparatus.

In the discussion that followed there was virtually unanimous agreement on the necessity for some kind of legal machinery for curbing electrical interference with radio reception, though there was some diversity of view as to the rigidity of the legal control that should be imposed. None of the speakers laid any great emphasis on the desirability of precise specification of legally permissible limits of interference, but many stressed the difficulties in the way of preparing such specifications. Suggestions for appropriate legal measures ranged from a plea for "enabling" legislation, which would permit a properly constituted authority to issue regulations, to a proposal that radio interference should be treated as a "nuisance" in common law. In support of the latter contention it was pointed out that in legal actions to abate nuisances from acoustic noise there was no obligation to specify precisely the levels of the noise.

Doubts were expressed as to the extent to which a law on a rigid quantitative basis could be enforced, and there was also the problem of ensuring proper maintenance of interference-producing devices. Much could be done by education both of those responsible for interfering apparatus and the users of radio receivers. Co-operation between the various interests concerned on both sides was considered to be vitally important.

The use of broadcast receiving aerials of greater effectiveness than those commonly

installed was urged, as was the use of screened down-leads. The directional properties of aerials might be more generally employed in improving signal-to-noise ratio in ultra-high-frequency reception.

Though it was generally believed that interference would increase after the war unless effective steps were taken to check it, the general opinion was that the trouble was not likely to be particularly serious at ultra-high frequencies. The physical size of the majority of interfering devices was such that most of the radiation was below 10 Mc/s. It was pointed out, however, that the radiation from ignition systems of motor vehicles covered a very wide frequency range. This was at present the most serious form of interference with u.h.f. communication services, which often worked with low field strengths, and would need protection for frequencies at least up to 300 Mc/s. It was stated that capacitors with properties suitable for interference suppression at frequencies above 50 Mc/s would probably soon become generally available ; existing designs were considered to be inadequate for this specialised purpose.

Some speakers thought that the newly developed technique of radio-frequency heating for industrial purposes would prove a serious source of interference; in one case, interference from an eddy-current heater had been experienced at a distance of half a mile from the source. Though it was agreed that the problem of suppressing radiation from equipment that might ultimately attain powers of the order of 1,000 kW and operate at frequencies up to 200 Mc/s was a formidable one, the view was expressed that a solution would be found by adopting a combination of known methods. These would include screening, which was quite practicable for small or medium powered equipment, and also a limited allocation of exclusive frequency bands.

Pleas were made for the exercise of reasonableness in approaching the problem, and to take local circumstances into account in estimating permissible radiated field strength. For example, there was no point in restricting radiation severely in circumstances where radiation at the particular frequency concerned could do no harm. Manufacturers of radio heating equipment should formulate their own code. A possible development of the future was for factories employing strongly interfering apparatus of any type to be built as screens.

In replying to the discussion, the opener expressed surprise at the unanimity of opinion in favour of legislative control. He agreed with the opinion that at first it would probably be necessary to accept a legally imposed low level of suppression.

Personnel for Industry

Selection and Training

A DISCUSSION on the selection and training of personnel for industry took place last month under the auspices of the London and Home Counties branch of the Institute of Physics. Dr. S. Whitehead (E.R.A.) presided as chairman of the branch.

MAJOR F. A. FREETH (Imperial Chemical Industries, Ltd.) opened the debate in a provocative manner, making many practical suggestions. He represented, he said, one of the largest employers of scientists in this country and his many years' experience of selection and training taught him that the two factors which needed to be kept in mind were a man's general intelligence and the possibility of his development over a long period in the right atmosphere. Men whose performance in university examinations had been poor, for which there might be some good reason, should not be overlooked. The crux of the whole matter was that a degree was merely an incident in a man's " upward flight "; he had never been very happy about the Ph.D. degree.

Major Freeth's plea for more training in the writing of clear English, particularly for those who had to present reports and appreciations of other people's work, was supported by several speakers in the general discussion during which a representative of a large electrical engineering firm suggested that the industrial physicist should serve an apprenticeship similar to that expected, for example, of engineers and architects. The need for the most careful selection of those entering industry with a view to occupying supervisory positions was stressed. Such men needed a wide knowledge rather than a specialised one, and universities and technical colleges were urged to educate and train men for leadership rather than for narrow vocational work. The great advantages accruing from contact with industry as part of a training scheme were pointed out and a " sandwich " system of up to five months in industry each year was recommended.

Several other speakers from industry stated that they did not expect entrants to their organisations from university and technical colleges to be employed on productive work until they had gained the special training and experience requisite for their particular industry, a matter of six months or more. They wanted the universities and colleges to provide them with good scientists having broad rather than deep knowledge, and they would attend to the rest.

Replying to the discussion, Major Freeth said that there was a very great demand for more libraries and books, and he certainly did not expect men to come from the universities and colleges " ready made." One new graduate had complained to him that he did not like working for other people's profit, and he had to remind him that he was in fact working for other people's loss ! He agreed wholeheartedly with the chairman's view that it was very desirable that the prestige of the newer universities and of the technical colleges should be more nearly matched to that of the older universities.

Design and Practice

Further Views on Turbo-Generator Standardisation

IN the discussion on December 7th on the paper, dealt with in our last issue, in which MR. G. A. JUHLIN reviewed the difficulties militating against standardisation of such large plant as turbo-generators at the Institution of Electrical Engineers, MR. J. HACKING (Central Electricity Board) agreed that complete standardisation was undesirable. It was better to leave some element of competition, although in this country, owing to the relatively large number of manufacturers, competition was likely to be considerable. There would undoubtedly be difficulty in reconciling the conflicting views of machine designers. The same could also be said with regard to standardisation of requirements because that involved consideration of the design of the transmission system, and there were differing views there. Nevertheless, the possibility should be studied. There would be great advantages in mechanical interchangeability, and a relatively simple item to standardise was the rotor.

There was much more generating plant out of commission in this country now than at any time in the past, and the largest single item of trouble was the rotor. Was there any statistical justification for the author's statement that it was general practice in Russia not to shut down machines except when essential for overhaul or examination? If there was, then the load factor in Russia must be very different from that in this country where it was necessary to shut down machines regularly every day or several times a week. Short-circuit reactance was one of the requirements which needed standardisation and it should be at a fairly high level, say 25 per cent. There might be good grounds for standardising the voltage at 11 kV, but there were certain points to be taken into consideration when making comparisons between various possible voltages.

Grid Simplifies Problem

DR. M. L. KAHN (G.E.C.) indicated a number of points which he claimed made standardisation much more simple than might appear at first. Since it would be two or three years before anything of a practical nature could be done, the whole subject should be taken in hand at once. The existence of the grid would enable standardisation to be carried out far more effectively and quickly than if there were a large number of disjointed power stations to deal with. The size of power station contemplated by the C.E.B. in the next few years was 200,000 or 300,000 kW in which case 30,000-kW and 50,000-kW sets would be sufficiently large. He agreed that at present the problem should be confined to mechanical interchangeability.

What had been found possible in wartime could surely be done in peacetime. If there was to be only one voltage then it must be 11 kV. He did not agree with standardising two power factors; 0·85 could be made stable.

He believed that in the future all regulators would be of the electronic type, which would be a great advantage for standardisation. Reactance of 25 per cent. would be found sufficient. Favouring separately driven exciters, he said that when they became universal station engineers would never understand why they had put up with the directly coupled type for so many years. In supporting the suggestion that a committee should be formed, he said the author would make a most efficient chairman.

Standardised "Batches"

MR. W. J. CARFREE (B.T.H. Co.) expressed the view that a limited degree of standardisation by individual makers would be practicable and useful. The purchasers would have to agree on standard terminal voltages, short-circuit ratio, power factor and reactance, in addition to temperature rise which was already fairly well standardised. Then the manufacturers would be able to build machines in batches of, say, six to ten to a given design. Experience would indicate to what extent modifications should be incorporated in the next batch. Any measure of standardisation would be welcomed by designers generally as it would reduce the time devoted to routine design calculations. Until users standardised their requirements it was useless to expect manufacturers to standardise their designs. Moreover, if special machines were made for export all standardisation would be partially nullified.

MR. W. KIDD (Manchester) favoured standardisation only if it would produce the desired results at a lower price and facilitate replacements after breakdown. He doubted whether standardisation would have all the advantages that some people expected. Alternators were not made by the thousand and were likely to be out of date by the time standardisation was achieved. A better result might be obtained by having a reasonable amount of national standby plant and by the grid having sufficient capacity in its interconnectors to deal properly with the transfer of load from one district to another. It was possible for users' requirements to be

standardised, but the present policy of asking for a big voltage range was really a legacy of the day when generating stations were also distributing stations. That was all wrong and should be altered. When the Barking power station was designed his calculations indicated that 25 per cent. reactance was required in the generator with its transformer unit, and as the result of recent work he had found no reason for changing that opinion. But reactance could be dealt with externally. He did not think that interchangeability of parts was worth while, so it would be very much better to standardise users' requirements. While agreeing with a standard voltage of 11 kV, he suggested that 33 kV should be added for distribution; 6·6 kV and 11 kV were much too low for distribution.

MR. P. MEARS (Ministry of Fuel and Power) discussed the paper as a user of electricity and said that standardisation originated in the hope that electricity would be cheaper as a consequence. A committee should be formed, but steps should be taken to deal with the matter quickly.

MR. A. J. GIBBONS (London Power Co.) said he would be sorry if standardisation were carried out in such a way that progress in design would be "frozen," which might occur if a rigid attempt were made to enforce detailed standardisation and mechanical interchangeability. There were, however, directions in which standardisation might be effected. Short-circuit ratios might well be standardised and from the experience of his company 0·8 to 1 had given excellent results. With regard to the separately driven exciter, he said that the lower speed of the independent drive facilitated the design of a really robust exciter and he had no qualms whatever as to the reliability of the driving motor, but he was a little exercised as to the supply arrangements for the independently driven exciters in order to ensure full reliability of supply to those very vital machines. He regarded 25 per cent. for reactance as the minimum. For high-voltage machines he preferred an external reactance.

MR. J. H. R. NIXON (Brush Electrical Engineering Co.) suggested that if a committee were appointed it might result in the chairman having to design the machine himself. In any case, any design arrived at by a committee would be a compromise and would need the production of new gauges, tools and fixtures and possibly manufacturing equipment. Even so, there would also have to be standardisation of insulation and impregnation and, indeed, the standardisation of materials. The whole subject was one of great complexity. The committee should be set up by the Institution and, if it were fully representative, it should command the confidence and respect of all the interests involved.

The author, in the course of his reply to the discussion, said it was pleasing to find so many of the speakers in agreement with him. If technical competition were jettisoned, they might lose a great deal more than was gained by standardisation. As to standardisation resulting in cheaper electricity, it was only reasonable to say that standardisation might actually increase the cost.

B.E.A. Annual Meeting

Linking Up Trade Associations

AT the thirty-second annual meeting of the British Engineers' Association held on December 7th at the Waldorf Hotel, London, resolutions were adopted unanimously confirming the arrangements which had been made for the linking-up of the sectional trade associations with the B.E.A., and for their representation on its governing Council. It had been decided previously that membership of the B.E.A. should be open to sectional trade associations mainly concerned with the mechanical engineering industry. During the past year some twenty sectional trade associations have been working in collaboration with each other through the B.E.A. and, with the largely increased membership of individual manufacturers, the work of the Association has grown extensively.

The director, Mr. A. W. Berry, M.I.E.E., referred to the close contacts maintained by the Association with the appropriate Government Departments. He mentioned the work of many Committees serving in the interests of the industry as a whole and to the importance of co-operative effort in securing the re-establishment of post-war export markets.

The Hon. J. K. Weir, C.B.E., managing director, G. & J. Weir, Ltd., was elected as a new member of the Council. At a subsequent Council meeting, the president, Mr. Cecil Bentham, M.Inst.C.E., was re-elected president of the Association. Lieut.-Col. H. B. Riggall, J.P., assistant managing director, Ruston & Hornsby, Ltd., and Mr. C. K. F. Hague, deputy managing director, Babcock & Wilcox, Ltd., were elected vice-presidents.

Sir Francis Joseph, Bt., K.B.E., acting chairman of the United Kingdom Commercial Corporation, Ltd., and Sir Charles Bruce-Gardner, M.I.Mech.E., Chief Executive for Industrial Reconversion (B.O.T.), addressed the members at the luncheon.

N.E. Companies Collaborate.—The North-East Engineering Bureau, which was formed recently to help expand the engineering industry in the North-East, now has more than 70 member firms subscribing to its income. These include large concerns like A. Reyrolle & Co., Ltd., C. A. Parsons & Co., Ltd., and Vickers-Armstrongs, Ltd. The Bureau is expected to begin its activities next month.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE North of Scotland Hydro-Electric Board has just appointed **Mr. C. L. C. Allan,** A.M.Inst.C.E., A.M.I.E.E., as assistant engineer. He previously held positions with the Central Electricity Board in London and with Balfour, Beatty & Co., Ltd., in Derbyshire and Nottinghamshire. Mr. Allan was apprenticed to Bruce Peebles & Co., Ltd., Edinburgh, and was educated at Merchiston Castle School, Edinburgh, and Cambridge University, taking an honours degree in engineering.

Mr. William Fennell, who has been engineer and manager of the Mid-Cheshire Electricity Co., Ltd., is retiring from that position and his work will be taken over by **Mr. J. E. Nelson,** chief engineer and manager of the Mersey Power Co., which is associated with the Mid-Cheshire Co.

Mr. Fennell was educated at the Coleshill Grammar School and the Davenant School, London. His technical training was gained at the City and Guilds Technical College, Finsbury, where he became senior student and personal assistant to Professor John Perry. He then joined the Galway Electric Supply Co. In 1896 he was appointed charge engineer to the House-to-House Co., Ltd., Kensington; and in the following year became assistant to a Westminster consulting engineer. In 1904 he went to Wednesbury as borough electrical engineer, a post which he held until 1914, when he served for a year as resident engineer in the contract department of British Insulated Cables, Ltd. Then for about three years he was resident engineer for St. Albans and district for the Northmet Co., joining the Mid-Cheshire Co.

Mr. W. Fennell

Mr. J. E. Nelson

in 1918. He is a director both of that company and of the Mersey Power Co. and will continue in this capacity to represent his company on electrical associations.

Among the work for which Mr. Fennell has been responsible during his term with the Mid-Cheshire Co. has been a good deal of rural electrification. An article describing what has been done in the company's area appeared in the *Electrical Review* of January 14th last. Mr. Fennell has been a very active member of the Institution of Electrical Engineers. He was president in 1928-29 of the Overhead Lines Association, which was merged in the I.E.E. Transmission Section, and he was chairman of that Section in 1935-36. He also served as chairman of the North-Western Centre of the Institution in 1938-39.

Mr. J. E. Nelson is already a director of the Mid-Cheshire Co. as well as of the Mersey Power Co. He has been engineer of the latter company since its establishment in 1911. Before that he was with the Yorkshire Electric Power Co. for about nine years. He had also been with Cammell Laird & Co., Cochran & Co., and the London Underground Railways. Mr. Nelson is a past-chairman (1940-41) of the Mersey and North Wales (Liverpool) Centre of the I.E.E.

Mr. Alexander Watson, A.M.I.E.E., expects to take up the position of borough electrical engineer of Darwen (Lancs.) in January. He succeeds Mr. F. M. Fletcher, who is retiring. A native of Bury, Lancs, Mr. Watson is forty-four. He was educated at Bury Secondary School and served his apprenticeship at the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd. He was a student at Manchester University, where he became an associate of the Manchester College of Technology, between 1917 and 1923, his studies being interrupted by eighteen months' service as flying-officer in the R.A.F. After the last war he joined the Bury Electricity Department, where he became assistant mains and consumers' engineer. He went to the Tamworth & District Electric Supply Co., Ltd., in December, 1925, as mains engineer, and three years later became senior assistant engineer (mains) with the Hackney electricity undertaking. In January, 1938, he was appointed deputy borough electrical engineer at Aberystwyth, obtaining leave of absence in December, 1940, to take up his present position of assistant mechanical and electrical engineer at the Air Ministry.

Mr. A. Watson

Lord Falmouth has been elected an honorary fellow of the Imperial College of Science and Technology.

Mr. W. H. Duncan, mains engineer to the Manchester Electricity Department, is to retire shortly on superannuation.

Mr. F. T. Fletcher has been appointed general manager of De La Rue Plastics, Ltd., as from December 1st.

Mr. A. C. Mack, lighting inspector, who has been in the service of the Hornsey Borough Council for forty years, is retiring shortly. His assistant, **Mr. F. Griffin,** has been appointed to succeed him. **Mr. V. Gallucci,** who was placed in charge of the Electricity Department's transport in a temporary capacity in 1941, has now been appointed permanent transport officer.

Mr. D. Radford has been appointed general manager of the plastics division of E. K. Cole, Ltd. He has for some time been works manager of both the radio and plastics factories at Southend. **Mr. F. C. Pullen,** another executive of the company, becomes sales manager of the plastics division. This side of the company's activities is being considerably expanded and is now largely devoted to solving plastics problems allied to general engineering. A new extension to the plant was recently opened by **Mr. N. C. Robertson,** M.B.E., director and general works manager.

Mr. R. A. Woods, B.Sc., A.M.I.E.E., distribution engineer to the West Midlands Joint Electricity Authority, has been appointed distribution engineer to the Birmingham Electric Supply Department and will commence his new duties on January 1st. Educated at Nottingham High School, he received his technical training at Loughborough Engineering College and University College, Nottingham, gaining the B.Sc. (Engineering) degree of the University of London with honours in 1926. In September of the same year he joined the staff of the Derbyshire and Nottinghamshire Electric Power Co. as junior mains assistant, becoming technical assistant two years later. In March, 1931, he was appointed technical assistant (distribution) to the West Midlands J.E.A., becoming distribution engineer in 1939, since when he has been responsible for the administration of the whole of its Shropshire Distribution Area including the town of Shrewsbury, and for operational, maintenance and constructional work.

Mr. R. A. Woods

Mr. B. Nuttall, M.I.E.E., has been appointed deputy borough electrical engineer of Huddersfield at a salary of £750 per annum, plus war bonus, and is expected to take up his new duties on January 1st. Mr. Nuttall has been chief technical assistant and constructional engineer to the Nottingham Corporation Electricity Department for the past thirteen years, before which he was with Ferguson, Pailin, Ltd. There were more than eighty applicants for the position, which fell vacant when Mr. F. A. Ellis became borough electrical engineer in January last. **Mr. E. Lunn,** former borough electrical engineer, whose services were retained, has now asked to be released from further duties.

Mr. C. G. Hopper has resigned his position of advertising manager to the Simmonds group of companies—Simmonds Aerocessories, Ltd., Simmonds Products, Ltd., Simmonds Development Corporation, Ltd., and Neville's (Liverpool), Ltd.—and has joined Boulton & Paul, Ltd., in the same capacity.

Mr. D. C. Brook has been appointed a director of the Nigerian Electricity Supply Corporation, Ltd.

As part of the ceremonies on " Stand Down " day, a luncheon was recently held in the staff canteen at British Insulated Cables, Ltd., attended by officers and men of the B.I. Home Guard—" A " Company of the 81st Lancs. H.G. Many complimentary references were made to the good work of " A " Company and to its many happy associations. In turn the B.I. was thanked for its ready assistance at all times. Major G. N. Roberts, the company commander took the chair and Mr. F. Waine, executive manager (commercial) on behalf of the B.I. thanked the officers and men for their services.

The men of " F " Company, 60th Surrey Battalion, Home Guard, who were largely drawn from one of the factories of the Philips Lamps group " mournfully celebrated " their farewell dinner on November 22nd. A feature of the function was a menu with a number of little humorous sketches produced by a member of the staff.

Mr. T. G. Simpson, generating engineer at the Blackburn Corporation's Whitebirk power station, completes forty years' service on the staff on December 26th and he has given notice of his intention to retire on superannuation.

Obituary

Mr. A. E. Moore.—Many past and present students of Manchester College of Technology will learn with regret of the death last week, at the age of sixty-seven, of Mr. Albert Edwin Moore, M.Sc. Tech., M.I.E.E., who in August retired from the position of senior lecturer in meter engineering and electrical measurements. He was also a member of the Board of the Faculty of Technology, Manchester University. Mr. Moore began his association with the College in 1900 when he was appointed lecturer and demonstrator in electrical engineering, and he was responsible for the development of the College's well-equipped electrical standardising laboratory.

During the last war he carried out research on submarine detection apparatus under the direction of the late Lord Rutherford. From 1919 to 1929 he was retained in a consultative capacity by Kelvin, Bottomley & Baird, and from 1929 to 1932 by Ferranti, Ltd. He designed a standard concentric dynamometer wattmeter for large AC and power measurements. Two papers which he read before the Institution of Electrical Engineers gained him the award of premiums.

Mr. J. H. Farthing.—We report with great regret the death, on December 10th, of Mr. J. H. Farthing who had been a director of the General Electric Co., Ltd., for about twelve years. He joined the G.E.C. in 1893 and most of his service with the company had been in Manchester. He had been manager of the company's Lancashire and Yorkshire District since 1914. Mr. Farthing was in his sixty-eighth year.

Mr. A. Boiston.—The death is reported from New York of Mr. Alfred Boiston of the International General Electric Co. Mr. Boiston was with the British Thomson-Houston Co. from 1925 to 1930 and represented the company in Brazil for a short time. He was forty-four years of age.

Dr. G. A. Tomlinson, whose death occurred on December 1st, was a principal scientific officer in the Metrology Department of the National Physical Laboratory.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

I.E.E. Examinations

WITH reference to the letter by Dr. E. Hughes published in the *Electrical Review* of December 1st, I would suggest dividing "Applied Heat (with Light and Sound)" into two parts namely :—Physics I "Applied Heat" (plus "Kinetic Theory and Viscosity") ; Physics II "Sound, Light and Outline of Atomic Physics."

Candidates for Section A, might be required to pass in *one* of these subjects. Students intending to specialise in communication engineering would find Physics II useful. Each part would normally require one evening per week per session.

When exemption is on a subject-for-subject basis it is a help to the student if one subject occupies him only for one whole evening per week. "Applied Heat (with Light and Sound)" is too large a syllabus for one subject, so far as the convenience of either the student or the technical college is concerned. "Heat Engines" might exempt from Physics I.

Technical College, St. Helens. WM. ILLINGWORTH PLACE, M.Sc., M.I.E.E., F.Inst.P.

Coal Clauses

AS an electrical consultant my interest in the article by Mr. H. Peace in your issue of December 1st is primarily on behalf of clients among large industrial consumers, as I have had negotiations with several electricity supply undertakings on this and other tariff questions with a view to obtaining more favourable terms.

In one instance of a consumer taking 1½ million kWh per annum, the present charge under the coal clause is no less than 32 per cent. of the total average price per kWh. Supply is taken from a modern generating station owned by a power company, from which I have failed to obtain an answer on behalf of my client to the question as to what purpose the surplus derived from the coal clause is applied. In correspondence with the company a figure of 1·42 lb. of coal per kWh was assumed (which was not contested), and this showed that during the past year my clients had paid approximately £550 more than the actual extra cost of coal. Is it not inadmissible for the company to do more than recover the actual extra cost of fuel?

Correspondence with the Central Electricity Board some time ago confirmed that the coal clause adjustment in the Board's standard grid tariff for Central England is at the rate of 0·001d. per kWh per penny per ton variation in the cost of coal. Is it the Central Electricity Board which receives the surplus derived under the coal clause? As Mr. Peace points out, 0·001d. per kWh is considerably in excess of the actual extra cost incurred in respect of coal, and I am in entire agreement with his statement that in calculating the adjustment 1·5 lb. of coal per kWh generated would be more reasonable than the present figure of 2·24 lb. The matter goes further than this, however, for there are both corporations and companies which charge less than the Board's figure of 0·001d. per kWh to their industrial consumers. Is the reason that if the Board's standard rate were passed on, the amount of extra profit they would make might embarrass them?

On the other hand, one corporation until January 1st of this year paid to the Board 0·00133d. per kWh for each penny per ton variation. The reason given was that the corporation had an out-of-date power station and the electricity department's financial position was such that it had no option but to pass on the whole of the increase, with consequent dissatisfaction to both corporation and consumers. However, as a result of negotiations between those concerned, the corporation is now charged at the Board's standard rate of 0·001d. per kWh. Yet the corporation charges its consumers 0·0011d. One is at a loss to know why 10 per cent. should be added.

Possibly one reason for this matter not having had more prominence is that most of the large industrial consumers are paying excess profits tax and therefore have not been particularly interested in their electricity costs. Otherwise some concerted action on their part might have persuaded the electricity undertakings to face the issue before now. With the approach of the end of the war, however, it seems time that industrial consumers should be alive to the actual position and that some immediate action should be taken to secure a revision of the present inequitable and chaotic arrangement.

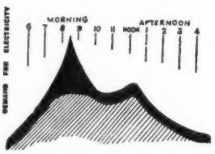
My last question is, why are the Electricity Commissioners apparently taking no interest in this matter, which is of considerable public importance?

Birmingham. H. R. HERRING.

Shifting Peak

YOUR leaderette relating to the above matter is most opportune. This undertaking has experienced a morning peak between 8 and 9 a.m. for the past seven years, and as the major portion of our load is due to residential property of good type erected in the last fifteen years, and well developed electrically, it will be appreciated that our load curve is very sensitive to weather con-

ditions. So much is this the case that the effect of a really cold day compared with a mild one is to increase our peak load by more than 50 per cent. In order to minimise this, I have made an appeal to our consumers by means of posters and personal letters, and have also inserted an advertisement in the local newspapers, which will appear in all issues until the New Year. This is a simplification of a daily load curve which I think will convey to the lay mind a clearer picture of what we require than if it were more correct.



Wilmslow. C. CAMERON KIRBY,
Engineer and Manager,
Alderley Edge & Wilmslow Electricity Board.

[The centrepiece of the advertisement, a typical domestic load curve, is reproduced above. The consumers are enjoined to "Keep Off the Peak, 8 a.m. to 9 a.m. War industries urgently need the power stations' plant at peak times."—Editors, *Electrical Review.*]

Demonstrators' Conference

Standardisation of Apparatus

A SPEECH by Mr. George Hicks, M.P., Parliamentary Secretary to the Ministry of Works, was a feature of a one-day conference of demonstrators organised by the British Electrical Development Association and the Electrical Association for Women, held on December 7th, at the E.A.W. headquarters. As Mr. Hicks was unable to be present, his speech was read by Mr. A. H. Moberly, of the Post-War Building Directorate of the Ministry. Miss Caroline Haslett presided over an attendance of about 130 demonstrators.

Mr. Hicks said that the I.E.E. report on electrical installations was regarded by his Ministry as being of great importance. Particularly valuable were the proposals for the improvement of electrical installations in small houses and flats, through the standardisation of the consumer's supply control, with its compact and convenient design. Other proposals of importance for the small house were the dimensional standardisation of apparatus; the standardisation of a simple universal type of socket outlet and plug; and the ring main.

The more the electrical industry was willing to fall in with these proposals for standardisation, the more economical would the installation become, and the more complete, therefore, would be the installation which it would be possible to provide. Demonstrators could do much to help in the programme, and manufacturers were bound to listen to their views when they were based on the experience of what the public really wanted.

Mr. V. W. Dale, general manager and secretary of E.D.A., stressed the importance of closer co-operation between the engineer and the architect, while Mr. E. G. Batt, chairman of the B.E.A.M.A. Post-War Housing Committee said that the introduction of the Government bulk housing programme had emphasised the necessity for standardisation and interchangeability of the parts of electrical equipment.

In the afternoon the conference met at the E.L.M.A. Lighting Service Bureau, when Mr. Clarence Parker, chairman of E.D.A. Council, presided and addresses were given by Mr. E. B. Sawyer and Mr. A. D. S. Atkinson on post-war lighting, with particular reference to the development of the fluorescent lamp. Mr. Atkinson said that a curved fluorescent lamp might be available after the war. Mr. T. O. Freeth outlined some of the possibilities of lighting for decorative purposes, such as flowers, mirrors, dining tables and luminous panels.

Forthcoming Events

Saturday, December 16th.—*Birmingham.*—Grand Hotel, 12.30 for 1 p.m. Birmingham Electric Club. Luncheon-reunion.

Swansea. — Guildhall, 3 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Standards of Performance of Generating Plant Based on Five Years' Operating Data," by R. W. Biles and G. W. Maxfield.

Leeds.—Metropole Hotel, 3 p.m. Association of Mining Electrical and Mechanical Engineers (Yorkshire North-West Branch). "Protection of Machinery at the Coal Face," by J. W. Davidson.

Monday, December 18th.—*London.*—Northampton Polytechnic, E.C.1, 5.30 p.m. Electrodepositors' Technical Society. "Electrodeposited Tin as an Undercoating," by Dr. S. Wernick.

Bradford.—Technical College, 6.45 p.m. Bradford Engineering Society. "Boiler House Efficiency," by V. R. Chadwick.

Tuesday, December 19th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Radio Section. Discussion on "The Television Receiver Sound Channel," to be opened by Dr. D. C. Espley.

Stockport. — Mersey Hotel, 7.30 p.m. Association of Supervising Electrical Engineers (Manchester Branch). Branch business.

Wednesday, December 20th.—*London.*—Institution of Electrical Engineers, 7 p.m. London Students' Section. "Condensation of Atmospheric Moisture on Insulation Surfaces," by J. F. Stirling.

Friday, December 29th.—*London.*—Room 19, Livingstone House, Broadway, Westminster, S.W.1, 6.30 p.m. Electrical Power Engineers' Association (Southern Divisional Meter Engineers' Group). General discussion.

Friday, January 5th.—*Chesterfield.*—Station Hotel, 6.30 p.m. Association of Mining Electrical and Mechanical Engineers (Midland Branch). "Electrical Testing and Measuring Instruments," by D. Blake.

Electric Tool Exhibition

The London Master Builders' Association is holding an exhibition of small electric tools for use in the building industry at the Connaught Rooms, London, W.C.2, next Monday (December 18th). Mr. F. C. Orchard, chief electrical engineer, Hornsey, is to open the exhibition with an address on the application of electric tools to building.

COMMERCE and INDUSTRY

More Utensils in Sight. Cut-out Patent Extended.

Aluminium Cooking Utensils

FOLLOWING the recent announcement by the Board of Trade that aluminium is to be made available for the production of household goods, manufacturers tell us that a limited range of special ground-base utensils for use on electric cookers will commence to be available in the near future, some makers giving " some time in January " as a probable date.

It is emphasised that supplies at first will be quite small and will depend not only on the deliveries of aluminium but also on the amount of labour available. No special provision for the latter is being made at present by the Ministry of Labour, and in any case production is not to be allowed in any way to interfere with war contracts still in hand.

Six items only are included in the range of articles to be made, and the Board of Trade, in consultation with the manufacturers, has fixed their prices. The items are:—Three sizes of saucepans, of 3, 5 and 7 pint capacity (6, 7 and 8 in. diam. respectively); a 10-in. frying-pan (8-in. base); and 3- and 6-pint kettles (8-in. base). In addition, special permits will be granted by the Board of Trade for making larger utensils for use in canteens, institutions, etc.

Grid Tariff Period Extended

The Electricity Commissioners state that the period fixed for the operation of a grid tariff for the South-West England and South Wales Electricity Schemes, 1930 to 1940, expires on December 31st next. The Central Electricity Board has submitted estimates of the trading results for the year commencing January 1st, 1945, on the basis of the existing tariff, and as a result the Commissioners have approved the continuation of the tariff for a further year.

British Industries Fair

Speaking in London last week the Secretary of the Department of Overseas Trade (Mr. Harcourt Johnstone) said that the B.I.F. Advisory Committee had been " resuscitated " and the first Fair would be held as soon as possible after the defeat of Germany. This might be in the spring of 1946 but it might not be possible to stage a really successful Fair until the following year.

Cheltenham Demonstration Houses

In our issue of November 10th (p. 677) we reported that the local electrical contractors had co-operated with the Cheltenham Corporation in the equipment of demonstration houses in the town.

Writing in the *Electrical Contractor* for December, " Pilgrim Two " (Mr. R. A. Parsons) says: " The report in the *Electrical Review* may be misunderstood by E.C.A. members, not that it is wrongly reported, but it does not go far enough. The E.D.A. Circle members found that only a very meagre supply of points was going to be installed, so they whole-hogged the four houses and put in enough points for the most fastidious tenant. They carried it out with room-ringed wiring, and, what is more, they dug down deeply into their own pockets, so that it should be an advertisement of the needs of any future tenant. He should not have to add points after the house is let and go knocking a nice new house about to provide real electrical amenities. It was a brave move, and at the recent Gloucester and District Branch meeting their efforts were warmly applauded." We are glad to supplement our report with this commendation.

Extension of Patent

In the Chancery Division of the High Court last week Mr. Justice Uthwatt had before him an application by Bulpitt & Sons, Ltd., as licensees of letters patent Nos. 295,872 and 338,392, for an electric device for preventing over-heating of electrical elements, for an extension of the patent.

For the applicants it was argued that the war had frustrated the activities of the company in the use of the patent to a very large extent. Counsel read an affidavit on behalf of the applicants, who were now fully engaged on war work, in which it was stated that they had over 35,000 electric kettles and other heating appliances awaiting repair and could not begin work on them until the war was over.

His Lordship granted an extension of one year. Counsel said the patent had already been extended from January, 1942, to October, 1943, so with the additional year it had expired. He applied, notwithstanding that he was out of time, for leave to file another application for a further extension.

His Lordship said application could be made on the existing summons in the matter, after carrying out the usual preliminaries.

Suspended Employee's Action Fails

In the King's Bench Division on December 7th, Mr. Justice Singleton concluded the hearing of an action by Mr. S. R. Marshall, against the English Electric Co., Ltd., claiming a declaration that the company was not entitled to suspend him for alleged indiscipline.

Mr. Morris, K.C., for the plaintiff, said the action involved the contract of employment. The defendants contended that a workman might be suspended without pay for indiscipline. His case was that the company had no inherent right to suspend a workman without pay. The defendants he understood pleaded that there was a custom in the works that a worker could be suspended for careless work or indiscipline. The plaintiff worked in the defendants' engineering shop and the works were subject to an Essential Work Order. In January, 1944, the plaintiff was suspended for a day without pay and this was challenged in the present case.

For the defence Mr. Littlewood, manager of the machine shop of the defendants' factory at Stafford, said that punishment by suspension was a well-known custom, and it had existed in the factory for many years for indiscipline. No one had ever questioned the right of the company to suspend workers. Other evidence

was called in support of this practice in many parts of the country and the plaintiff called eleven witnesses in support of his case.

His Lordship in giving judgment, said the case arose more or less under the Essential Work Order. The defendants carried on a scheduled undertaking within that Order. On January 9th, 1944, the plaintiff was suspended for three days, on the ground of indiscipline—careless workmanship. The matter came before the local committee and the appeal failing, this action was brought.

The company's case was that it was an implied condition that should the plaintiff be guilty of indiscipline they could suspend him without pay, and that this was a practice in that part of the country and was well known to the plaintiff. Defendants had satisfied him that they were entitled to suspend the plaintiff for careless work for a reasonable time, and he did not accept the view that this was void for want of certainty. That finding was sufficient to dispose of the case. On the question of custom his Lordship came to the conclusion that the practice or custom was general in Stafford and adjoining parts of the country, but was not universal. He gave judgment for the defendants with costs.

Payment for Services

Recommendations by Bolton Corporation Electricity Committee regarding payment for professional services on extensions at Back-o'-the-Bank electricity works have been considered by the General Purposes Committee. In respect of services in 1940 and 1941 it was recommended that a sum of £5,200 should be paid to the borough electrical engineer to be allotted to himself, his staff and other Corporation officials. In regard to extensions from the present to 1946 a further payment was recommended if similar services were rendered. The Committee deferred consideration of the first recommendation for a month. The second was referred to a special committee which will discuss the extensions, etc., with representatives of the Central Electricity Board.

Transfer of Retail Business

Burnley Electricity Committee has rescinded its resolution to lodge an objection with the Price Regulation Committee against the granting of a licence to an electrical firm to transfer its retail business from Plumbe Street to property adjoining the municipal electricity showrooms in St. James's Street. The matter was referred back to the Committee at the October meeting of the Town Council by a margin of one vote. When the Committee's decision to rescind its previous resolution came before the Council on December 6th, there was a further long and heated debate before it was approved.

New U.S. Fluorescent Lamps

A new line of "thin" fluorescent lamps, approximately half the diameter of present popular sizes, has been announced by the American General Electric Co. The longest unit in the new "slimline" series is only an inch in diameter and nearly 8 ft. long; others are two ½-in. diameter sizes, three ⅝ in. in diameter and 5 ft. long and another a 1-in. lamp approximately 6 ft. long. The company believes that a limited number of samples of the ½-in. lamp will be available to lighting engineers for design purposes, while samples of the 6- and 8-ft. lamps will be provided as soon as manufacturing conditions permit.—*Reuter's Trade Service.*

Gauge and Tool Makers

During the past year the membership of the Gauge and Tool Makers' Association has almost doubled; it is now 130. It was to be proposed at an extraordinary meeting to follow the second annual meeting yesterday (Thursday) that the articles of association should be revised to reduce the minimum subscription from 30 guineas to 15 guineas. The object is to facilitate the entry of the smaller concerns into the Association. The Council's report showed that close relations with Government Departments and with other organisations had been maintained and that the Export Committee set up last March had been very active. A Joint Research Committee has been set up by the Association in conjunction with the Machine Tool Trades Association and the National Federation of Engineers' Tool Manufacturers.

Freak Lightning Damage

On December 2nd, a dull, showery day, a solitary flash of lightning caused considerable damage to electrical equipment, mostly in the neighbourhood of a Huddersfield municipal housing estate of some two hundred houses. Representatives from the Electricity Department were soon on the spot as a result of urgent complaints of failure of the supply. One house was almost roofless, and the ceilings of two bedrooms were perforated in a peculiar manner, the holes resembling those made by rifle bullets. There were about ninety holes in one bedroom ceiling, and thirty in the other, the holes being approximately ⅛ in. in diameter, and 6-9 in. apart.

The whole of the porcelain mounted on the distribution board and in the main cut-out was blown to fragments and the iron covers torn off. Complaints were received from twenty-two houses, and in comparatively few cases were these adjacent to one another. Two complaints were from premises thirty houses apart. In nearly every case the distribution board and main cut-out were damaged; in five houses the meter was burned out; and in three the radio had suffered badly. In addition to the houses on the housing estate, several within a mile radius were affected, but the damage consisted mainly of blown fuses.

Introduction to Engineering

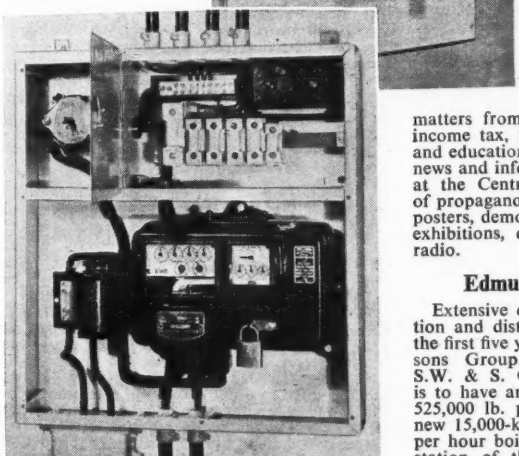
An introduction to conditions in a really modern engineering works was given to Leicester schoolboys at a recent exhibition arranged by the local engineering employers' association and the Leicester Education Department. In a section of the Granby Halls examples were set out of modern engineering equipment—lathes, milling and drilling machines, grinders, presses, hardening and tempering furnaces, drawing office equipment, and precision instruments of many kinds, all housed and operated under excellent conditions. The walls of this model engineering shop were light stone in colour; the machines, each driven by an electric motor, were painted primrose colour. In the absence

of shafting, the lighting engineers were able to make a good showing. "Osram" fluorescent tubes were installed, providing a relatively high lighting intensity without inducing hard shadows or harmful reflections from the many highly polished surfaces.

Though primarily an exhibition staged specifically to further the industrial education of juveniles of approximately school leaving age, it was in actual fact, an engineering shop where work of national importance was being carried out. The opening ceremony was performed by the Minister of Labour and National Service.

House-service Unit

A compactly arranged house service unit, which is said to be based on the Ministry of Works proposals, has been produced by Victor H. Iddon, Ltd., Harper Road, Wythenshawe, Manchester. It consists of a sheet steel carcase, fabricated by resistance welding, divided into three separate sections. The largest of these compartments contains (left to right) a solid connection for the neutral conductor beside the main 60-A fuse of an HRC cartridge pattern directly above a flush-mounted sealing box for terminating the supply authority's incoming cable. The kWh meter may be either of the quarterly or prepayment type; if the latter, its coin box can be removed without disturbing the front cover of the compartment, which incorporates facilities for the attachment of the supply authority's seals. The double-pole main switch (upper left) is of a 60-A rotary type and is housed in a separate compartment with a fixed front cover on which is mounted a circular label suitably inscribed to denote the switch positions. The only compartment accessible to the householder, by means of a hinged door, is the one housing the distribution fuses.



Sheet-steel house-service unit

The various lighting and power circuits are tapped off a common busbar and multi-way solid neutral connector. All wiring, terminals, etc., are screened by means of a barrier of insulating material, arranged so that only the fuse handles project. This barrier also carries inscriptions denoting the circuits to which the respective fuses apply. Accommodation is also made in this compartment for the housing of a bell transformer (top right).

The model illustrated is a typical arrangement for cooker, power plugs, water heater, washboiler, refrigerator, lighting, and bell circuits with allowances made for future extensions and variations according to consumers' requirements.

The two types available are for direct wall mounting, or recessed with the front panel flush with the surrounding wall. The sole difference between the two types is the position of the main fixing lugs.

Works Relations

The functions and scope of works relations were outlined recently in an address to the Incorporated Advertising Manufacturers' Association by Mr. S. O. Shave, works relations officer, British Belting & Asbestos Co., Ltd., at the Works Relations Centre of the Ministry of Supply at Ivybridge House, Adam Street, W.C.2. They included, he said, operational training, health topics, exposition of financial matters from increases in canteen charges to income tax, the advertising of social, sporting and educational events, and the broadcasting of news and information. An exhibition arranged at the Centre indicates the various methods of propaganda that may be adopted—speakers, posters, demonstrations, wall newspapers, films, exhibitions, displays, charts, photographs and radio.

Edmundsons' Post-war Plans

Extensive developments both on the generation and distribution sides are planned during the first five years after the war by the Edmundsons Group. As already announced, the S.W. & S. Co.'s power station at Stourport is to have an additional 60,000-kW set with a 525,000 lb. per hour boiler installed, while a new 15,000-kW generator with two 100,000 lb. per hour boilers will be provided at the Hayle station of the Cornwall Electric Power Co. Together these two extensions will cost over £2,600,000 and will bring up to 674,500 kW the total plant capacity of the Group, which at present operates seven "selected" stations and owns six of them. Further extensions and the erection of new stations are also anticipated to meet the demand for electricity as the development programme proceeds.

Over £15 million is to be spent on the distribution side and work will be commenced immediately the necessary material and labour are available. During the five years it is proposed to make electricity available to at least 85 per cent. of the 900,000 premises in the territory (more than a quarter of England and Wales) served by the Group. If this aim is achieved, all potential consumers on the route of the mains will have supplies. Just obtaining new connections is not, however, the final objective but the maximum use of electricity. Particular efforts will be made to encourage farmers to take the fullest advantage of electrical appliances.

Manchester Exhibition House

Last week, the Lord Mayor of Manchester opened on a site in Piccadilly a replica in wood (with very slight modifications) of the Portal pressed steel bungalow. It has been built and equipped by the Ministry of Works, the electrical appliances, with the exception of the lighting fittings, radiators, refrigerator and radio set, having been lent by the Manchester Corporation Electricity Department. Apart from the solid-fuel fired stove provided in the living room, the equipment is electric throughout. Similar equipment will, it is proposed, be provided in approximately 50 per cent. of the 3,000 temporary factory-made houses for which Manchester Corporation has applied. The wiring installation in this bungalow was carried out entirely by the Ministry of Works. In addition to the cooker, washboiler, refrigerator and circulator type water heater, which are supplied as a standard part of the equipment, the bungalow exhibited is provided with radio set, clock, kettle, iron, vacuum cleaner, and three radiators.

The total loading of the apparatus is 18·7 kW. The cost of electricity naturally varies according to size of family, habits, weather, etc., but the Electricity Department's records show that, with a family of two adults and two children, the equipment exhibited, when used to an average extent, will consume 4,680 kWh per annum. The weekly all-in cost of light, power and heat (excluding cost of solid fuel burned in living-room stove) is then 4s. 4d., made up of a fixed charge of 7d. under the "all-in" tariff, and a "unit" charge of 3s. 9d. (90 kW at ¼d.).

Fatalities

Repairs to Lift.—An electrical lift engineer, Robinson Kirtley Newton, aged thirty-two, employed by Pickerings, Ltd., received a fatal electric shock while repairing a lift at a Darlington café. At the inquest it was stated that Newton, who was highly skilled, had neglected the precaution of switching off the main power switch before attempting to correct a fault in the control box. The coroner said that the oversight was probably due to Newton's anxiety to get the job done.

Shock from Garage Lamp.—A twelve-year-old boy, Victor Burrows, North Bersted (Sussex), sent by his mother to fetch some coke from the garage, was later found lying on a pile of coke with the garage electric lamp, still alight, in his hand. At the inquest a foreman of the Bognor Regis & District Electricity Co. suggested that the boy had jumped for the lamp and stumbled on the coke. The boy's father described how he had installed the light in the garage. Recording a verdict of "Accidental death" the coroner said that nobody was to blame.

Trade Publications

British Thomson-Houston Co., Ltd., Bridle Path, Watford Junction, Herts.—Bulletin (No. 6) reviewing and illustrating pre-war street lighting practice. After explaining the necessity for good street lighting and defining with the aid of illustrations what is meant by that term, the booklet deals with existing codes of practice and indicates suitable equipment, ending with some legal notes and administrative considerations.

Mullard Wireless Service Co., Ltd., Century House, Shaftesbury Avenue, London, W.C.2.—Pamphlet and brochure containing descriptive specification with circuit diagrams of the E. 800-type cathode-ray oscillograph, of which a limited quantity is now available.

Mallory Metallurgical Products, Ltd., 78, Hatton Garden, London, E.C.1.—Well illustrated booklet describing the properties of strong castings of high conductivity copper alloys, and their application in such directions as circuit-breakers, arc furnaces and resistance welding machines. Advice is given on machining, soldering, silver brazing and electroplating.

English Electric Co., Ltd., Stafford.—Illustrated folder (WA/101) describing AC single-operator welders of 11·5 to 36 kVA on wheels for indoor and outdoor use, with hints on how to connect up and maintain these machines.

Frank Whitelegg, 90, Robinhood Lane, Sutton, Surrey.—Priced list (SS.2) describing heavy strip-coil holder with adjustable quadrant top for feeding inclined presses.

Watford Instruments, Loates Lane, Watford, Herts.—Pamphlet technically descriptive of B-model "strobolyser" for the purpose of analysing recurrent motion.

Meritus (Barnet) Ltd., Wood Street, Barnet, Herts.—Illustrated leaflet (No. 11/43) describing extensible brackets for industrial local lighting.

Bona fide trade applicants can obtain copies from the companies concerned.

TRADE MARK APPLICATIONS

THE following applications have been made for trade marks. Objections may be entered within a month from December 6th:—

GEL-CEL. No. B629,079, Class 9. Electric accumulators.—Chloride Electrical Storage Co., Ltd., Exide Works, Clifton Junction, near Manchester.

CERAMETAL. No. 630,350, Class 9. Parts (not included in other classes) of scientific, electrical, etc., apparatus and instruments, etc.,; all of common metal or common metal alloys. Also No. 630,351. Class 11. Parts (not included in other classes) of installations for lighting, heating, steam generating, cooking, refrigerating, drying, ventilating, etc.—Bound Brook Bearings (G.B.), Ltd., Birch Road, Witton, Birmingham, 6.

RENCOL. No. 628,016, Class 17. Electrical insulating material, and electrical insulation parts; all of thermo-setting or thermo-plastic materials.—Ray Engineering Co., Ltd., Waterdale Works, Southmead, Bristol.

Steam Condensers

Factors Effecting Efficiency

By C. H. Fielding

VACUUM in a condenser may vary from normal from two causes, namely air leaks and fouling of tubes. Air leaks are detected by a widening of the interval between the exhaust steam temperature and the condensate temperature, which in accordance with Dalton's law that the total pressure in a closed vessel containing several gases is the sum of the individual pressures which each gas would exert in filling the vessel independently.

Total pressure in a condenser is indicated

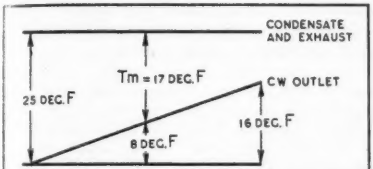


Fig. 1.—Temperature conditions for clean condenser

by back-pressure, which is the sum of the vapour pressure (corresponding to the condensate temperature found from steam tables) and the pressure of any air present.

In condensers installed about twenty years ago there was usually a big pressure drop across the tube banks which resulted in a difference of temperature between the condensate and exhaust steam of anything up to 4 or 5 deg. F., but in modern designs, the two temperatures are practically equal. The operator can, therefore, quickly detect any air leaks by observing any divergence of the condensate and exhaust temperatures.

The heat equation for any condenser is $W \times h = KSTm$, where W = weight of steam entering the condenser per hr., h = heat in one pound of this steam, K = heat transfer co-efficient (BThU per sq. ft. per deg. F. per hr.), S = area of the tube surface in sq. ft. and Tm = mean temperature difference between steam and water.

For any given conditions, the mean temperature difference varies inversely with the heat transfer co-efficient K and is a logarithmic function. The arrangement of the formula for the mean temperature difference depends upon the number of passes which the water makes through the condenser. For rough calculations, however, the arithmetic mean temperature difference may be taken without serious errors. As an example, suppose a turbine is operating at its maximum economic rating, the temperature rise of the circulating water is 16 deg. F., the mean temperature difference is 17 deg. and K = 500. Take also the condensate and exhaust temperatures to be equal. The conditions will then be as shown in Fig. 1. It will be seen that the interval between the temperatures of the circulating water inlet and of the exhaust steam is 25 deg. F., which is the usual figure found for a clean condenser at the most economical rating of the turbine.

As the condenser becomes dirty the value of K decreases, with a corresponding increase in the mean temperature difference. Since, for given steam conditions, the product $K \times Tm = \text{constant}$, $Tm_2 = \frac{K_1}{K_2} Tm_1$, where $K_1 Tm_1$ refer to clean conditions and $K_2 Tm_2$ to dirty conditions. Suppose, for example, that K = 500 at Tm = 17 deg, then with a value of K = 400, Tm will be $\frac{500}{400} \times 17 = 21{\cdot}20$ deg. By taking various values of K we can find the corresponding mean temperature differences, as in Table I with assumed conditions of circulating under temperature rise of 16 deg. F. and inlet temperature of 75 deg. F. For the lower values of K the figures will be on the high side, because as the vacuum falls off the steam consumption of the turbine and consequently the heat rejected to the condenser increases, whereas we assumed it to be constant. The figures obtained in Table I are shown in Fig. 2.

By noting the exhaust steam temperature against any c.w. inlet temperature, we can get a mental picture of the state of the condenser, without considering vacuum or condenser efficiencies.

So far we have only considered steady load conditions. Experience shows, however, that the temperature interval between the exhaust steam and the circulating water inlet varies lineally with load. Usually duplicate circulating pumps are installed, each capable of maintaining approximately half-load conditions. One pump alone will deal with about 60 per cent. of the water circulated by two pumps in view of the progressively higher discharge head produced when more

TABLE I

K	Tm. deg. F.	Temperature interval c.w. inlet to exhaust steam, deg. F.	Exhaust steam temperature, deg. F.	Corresponding vacuum, in Hg.
500	17·0	25·0	100·0	28·05
400	21·20	29·29	104·20	27·80
300	28·40	36·40	111·40	27·27
250	34·00	42·0	117·0	26·80

than one pump is working on the c.w. system. The value of K is affected by the water velocity passing through the tubes. Fig. 3 relates to a modern condenser, the points being plotted over a short period. Normally after cleaning the value of K is 500 or perhaps slightly above, falling within a month or so to somewhere between, say, 350 and 400, where it remains for many months, after which it generally falls off rapidly, necessitating cleaning of the condenser.

Fouling depends upon the kind of make-up water used. Temperature has a big influence, since the minute plant life, which is the chief cause of fouling, develops quickly at higher temperatures, say 80 deg. F., and much more slowly under winter conditions.

Water treatment is widely carried out to inhibit this growth, giving from six to nine months between cleanings without reducing the value of K below say 300 BThU. Fig. 3 shows that the variation of the temperature

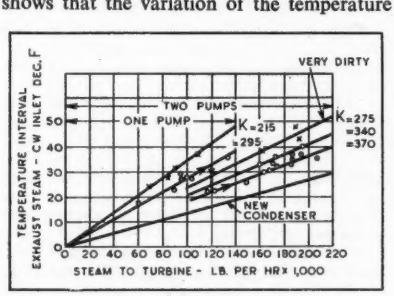


Fig. 3.—Variations of temperature interval with turbine loading

intervals, exhaust steam—circulating water inlet, can be taken as lying on a straight line for any value of K. For the particular condenser to which Fig. 3 refers, the values at which K settles down for the biggest part of its run between cleanings are those indicated by the lines possessing arrows.

One circulating pump is run up to a steam flow of 120,000 lb. per hr. after which the second pump is put on load. Immediately the second pump is put on, the temperature interval, exhaust steam—circulating water inlet, is reduced from 33 to 22 deg. F. Assuming a circulating water of 75 deg. F., entering the condenser, the vacua to be expected would be as shown in Table II.

As in most modern units in stations employing cooling towers, the nominal vacuum at the maximum economic rating of the set is 28·0 in., at the maximum continuous rating 27·5 in. Fig. 4 is plotted from the results of

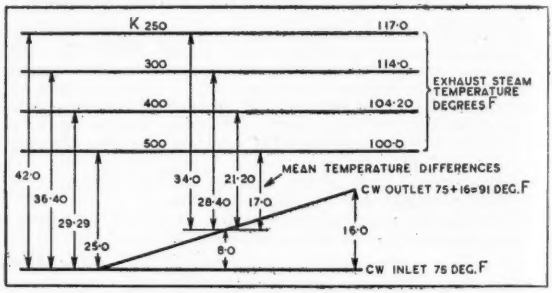


Fig. 2.—General effect of fouling of tubes

tests extending over some two years on another condenser at the maximum continuous rating of a straight condensing unit; as exactly the same load could not be maintained on each test, some of the points lie slightly off the curves.

Values of the mean temperature difference (logarithmic) are plotted against the value of the heat transfer co-efficient found in the test and on the same base is also plotted the value of the temperature interval mentioned previously. The latter quantity allows a close check to be kept on the value of K, and hence on the cleanliness of the condenser. Curves for this unit, built up from Fig. 4, are given in Fig. 5 to enable the state of the condenser to be checked at any load.

As an example of the use of the heat transfer co-efficient, K (*i.e.* the BThU per hr.

TABLE II

Steam entering condenser, lb. per hr.	Temperature interval from Fig. 3	Exhaust steam temperature, deg. F.	Vacuum to 30 in. bar.
40,000	11·0	86·0	28·745
60,000	16·2	91·2	28·30
80,000	21·8	96·8	28·24
100,000	27·5	102·5	27·906
120,000	33·0	108·0	27·545
140,000	25·5	100·5	28·025
160,000	29·0	104·0	27·81
180,000	33·0	108·0	27·55
200,000	36·8	111·8	27·25

which will flow across one sq. ft. of tube surface when subjected to a difference of temperature of 1 deg. F. between the inner and outer surfaces) we can take a condenser tube bank having an average value of K = 500 and a mean temperature difference between the steam and water sides of 20 deg. F. The heat flow across each sq. ft. of tube surface will be 500 × 20 = 10,000 BThU per hr. If 400,000 lb. of steam enters a

given condenser per hour, and the latent heat is 900 BThU per lb., then the condenser tube surface area will have to be $\frac{400{,}000 \times 900}{10{,}000} =$ 36,000 sq. ft.

Flow of heat is analogous to the flow of electricity and is equivalent to conductance (K) × heat potential (temperature). Just as the numerical value of electrical resistance (and consequently its conductivity) can only be found by experiment, so too must the value of K be determined.

As the conductance of an electric circuit varies with temperature, so does the value of K vary with the mean temperature of the water passing through the condenser tubes. The passage of heat through a tube takes place in three stages—first, through a stagnant layer of water adjacent to the inner tube surface, secondly through the metal itself and lastly through a stagnant layer of gas at the outer tube surface. If K = the overall co-efficient of heat transfer, K_s = the co-efficient from steam to tube, K_w = the co-efficient from tube to water, x = the tube thickness and k = the thermal conductivity of the tube metal, then $\frac{1}{K} = \frac{1}{K_s} + \frac{x}{k} + \frac{1}{K_w}$. Since K is a unit of conductivity and the resistance to heat flow equals 1/K, say, R, then the above equation becomes $R_s + R_m + R_w$, which is identical with the equation for the resistance of series electric circuits.

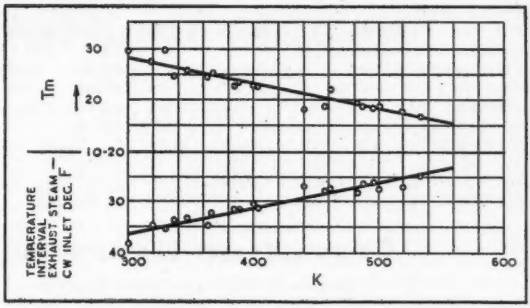


Fig. 4.—Heat transfer co-efficient in relation to temperature differentials

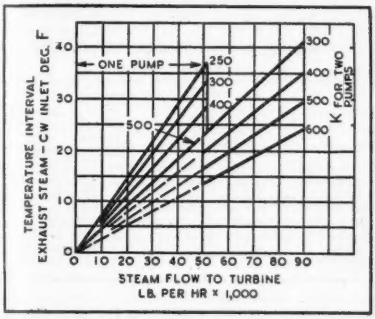


Fig. 5.—Mean differences between steam and water at various turbine loads

K is also influenced by the water velocity in the tubes, as well as by the mean water temperature itself. According to Guy and Winstanley* the value of K can be calculated from the following equation for commercially clean tubes :—$K = 650\sqrt{\frac{v}{5}}\sqrt[4]{\frac{t}{100}}$, where v = the water velocity in ft. per sec. and t is the mean value of the water temperatures entering and leaving the condenser.

If the water velocity with two pumps is 6 ft. per sec. and is reduced by taking off one pump, then the above-mentioned value of K is reduced to 0·816 k for 4 ft. per sec., to 0·765 k for 3·5 ft. per sec. and to 0·707 k for 3 ft. per sec.

The factor C in $K = C\sqrt{\frac{v}{5}}\sqrt[4]{\frac{t}{100}}$ as used in Fig. 6 is the heat transfer co-efficient obtained with a water velocity of 5 ft. per sec. and a mean water temperature of 100 F. To obtain the heat transfer co-efficient at any other value of velocity and temperature it is therefore necessary to multiply C by the factors set out in the equation above. It will be seen that the heat

* "Some Factors in the Design of Surface Condensing Plant," Guy and Winstanley. Proc. I. Mech. E. Vol. 126.

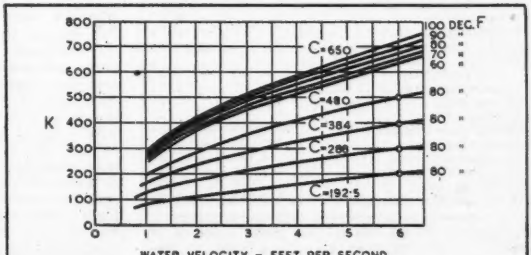


Fig. 6.—Relationship of heat transfer and water velocity

transfer co-efficient varies as the square root of the water velocity and the fourth root of the mean water temperature.

The values plotted in Fig. 6, where t is shown in each case as an ordinate on the right-hand side, apply to new clean tubes, but after the condenser has been in service for any length of time, they are unlikely to be obtained again, since with usual methods of cleaning an absolutely clean surface is unobtainable. The curve values will therefore be higher than those found in actual practice.

The effect of variations in water temperature is seen to be relatively small, except for extreme weather conditions or loading. The effect of variations in the water velocity, on the other hand is large, and shutting down one of two pumps can reduce the value of K by 25 per cent. The shutting down of one pump below, say, half load is of course justifiable, but the effect is reduced by the foregoing.

Argentine Overseas Trade

Imports and Exports Decrease in 1943

IMPORTS of electrical material into Argentina in 1943 declined in value by roughly 60 per cent. compared with 1942, following a marked drop in that year. The only noteworthy increase was in telephone cables and vacuum cleaners. The chief items in this trade have been extracted from the recently issued official returns and are shown in Table I which also gives notes of increases or decreases in the values between 1942 and 1943.

TABLE I.—IMPORTS

Class of Goods	1943 Pesos (000)	Inc. or dec. on 1942 Pesos (000)
Dynamos and motors	2,568	− 1,570
Fan motors	8	− 189
Cable and wire up to 5 mm. covered with cotton, rubber, etc.	130	− 492
Cable and wire over 5 mm. covered with cotton, rubber, etc.	2	− 63
Cable and wire up to 5 mm., lead-covered	159	− 147
Cable and wire, silk-covered	2	− 86
Cable and wire, enamelled	76	− 173
Flex, covered with cotton, wool, etc.	70	− 222
Flex, silk-covered	88	+ 35
Telephone cables, underground, lead-covered and steel or iron armoured	132	− 391
Telephone cables, iron or steel, covered with cotton, gutta-percha, etc.	245	+ 142
Accessories for underground cables	4	− 13
Accumulators and parts	558	− 1,177
Batteries	85	+ 54
Ammeters and voltmeters	42	− 94
Radio-telephone apparatus	99	− 218
Receiving sets	367	− 427
Loudspeakers, metal	27	− 407
Radio-telephone parts	703	− 4,223
Telephones	878	− 149
Telephone material	418	− 247
Cookers, toasters, heaters, etc.	2	− 27
Switches, circuit-breakers, cut-outs, fuses, etc.	222	− 598
Vacuum cleaners	707	+ 355
Electric bells	15	− 4
Insulating tape	5	− 17
Change-over switches	1,825	− 1,842
Electric furnaces	603	+ 219
Incandescent lamps	1,790	− 780
House-service meters	3,244	+ 1,021
Insulating tubes	9	− 21
Other electrical materials	2,043	− 2,247

Similar information relating to the principal groups of electrical exports is given in Table II.

In this comparatively new development the progress which had been maintained in 1941 and 1942 was checked and there was a drop of about 30 per cent. The values stated are those of the invoices, and the exchange rate for the peso may be taken at 17 to the £.

The Argentine Government has recently adopted a more friendly attitude to British interests and granted to the British-owned railway companies a more favourable exchange rate, viz., 14 pesos for payment for imported materials. An Argentine economist has recently estimated what machinery, industrial equipment, materials, etc., will be required to replenish stocks and rehabilitate the country's industrial plants after the severe wear and tear and difficulties of replacement during the war. He places the value at 4,390 million pesos, a total which exceeds the aggregate value of all Argentine imports for the years 1937, 1938 and 1939.

TABLE II.—EXPORTS

Class of Goods	1943 Pesos (000)	Inc. or dec. on 1942 Pesos (000)
Generators	36	+ 14
Motors	115	+ 5
Accumulators, batteries and parts	605	+ 572
Telephone material	169	− 96
Radio apparatus and parts	1,059	− 2,356
Lamps	53	− 353
Other electrical goods	1,520	− 403

Tin-plating Copper Wire

OVER 400 American industrial concerns showed their wares recently at Cleveland at the National Metal Congress. One of them demonstrated a high-speed electro-tinning process for copper wire, which is said to utilise only half as much tin as older methods. The machine, which is 30 ft. long, can coat electrical wire ranging in sizes from those about as fine as a human hair up to heavy gauges. It was exhibited by E. I. du Pont de Nemours & Co. and was designed and constructed by the National-Standard Co. to utilise the Du Pont "Halogen" tin-plating solution, which has already been extensively employed in the electroplating of strip steel for food cans. In the latter application the process has saved important tonnages of tin by replacing the hot-dip method.

New Durham Station

Inquiry into Use of Kepier Site

PROPOSALS of the North-Eastern Electric Supply Co., Ltd., to build a £3,500,000 power station at Kepier just outside the boundary of Durham City were the subject of a joint inquiry lasting three days at the Shirehall, Durham, by the Electricity Commissioners and the Ministry of Town and Country Planning. Sir Cyril Hurcomb presided and others on the tribunal were Mr. G. L. Pepler and Mr. C. G. Morley New. The chief opponents of the plan were the Durham City Preservation Society, of which the Dean of Durham (Dr. C. A. Alington) is chairman. An aerial view of the countryside showing the location of the new station was on view and the tribunal also visited the site.

Mr. Craig Henderson, K.C., opening the proceedings, said that the Central Electricity Board had decided that there was a real need for a new power station in the mid-Durham area to meet future demands. By 1948 there would be a shortage of about 99,000 kW. The present load in the mid-Durham area was about 132,000 kW, comprising 60 per cent. colliery load, 27 per cent. other industrial undertakings and 13 per cent. low-voltage for houses, shops, etc. Only a site near the the River Wear was suitable, and the Kepier site was the only one which fulfilled requirements. Sites at Plawsworth and Grange had been rejected because of unsuitable foundations. The mid-Durham area was honeycombed with mine workings, but coal had never been worked under the Kepier site, and was not likely to be. The capacity of the station would be 100,000 kW (two 50,000-kW sets) which could be expanded to 150,000 kW by the addition of a third similar set.

Designed by Sir Giles Scott

The new building would reach a high level of industrial architecture. It had been designed by Sir Giles Scott, designer of the Battersea power station which had often been described as a " thing of beauty." The new station would be built north-east of Durham City and the prevailing wind came from the south-west; therefore any smoke or grit which did come from the 350-ft. chimneys would be blown away from the city. An electrostatic dust precipitating system would remove 97 per cent. of the dust arising from combustion. There would be six cooling towers 170 ft. high and these would be designed to harmonise with the rest of the surroundings.

He complained of the manner in which the " Nesco " had been treated by the opponents of the project. Because of the suggestion that a famous view of the cathedral would be threatened protests were made from all over the country against the " vandalism " of the company. This famous view was in fact not threatened at all.

The first witness to be called was Mr. John Hacking, chief engineer to the C.E.B., who said the Board agreed that the Kepier site was the most suitable. The station should be completed not later than 1947 otherwise there would be a shortage of power in coming years. Colonel E. E. Woodward, general manager and director of " Nesco," stated that originally 13 sites were considered, all on the River Wear. Mr. Charles Blackburn, consulting engineer to the company, considered that they had achieved a rather outstanding design for the proposed station. Professor David Brunt, meteorological expert, said that there would only be a fractional increase in the dust content of the air.

Opponents' Case

Mr. J. F. Duff, Warden of Durham Colleges and Pro-Vice-Chancellor of Durham University, said that the University was not opposing the scheme but was concerned with the effects of the emission of dust on the stone-work of Durham Castle on the restoration of which £125,000 had been spent. They were also concerned with the effect on the University's meteorological and astronomical work.

Mr. C. Paley Scott, K.C., stating the case for the Durham Preservation Society, said the location of the station was dead against all the principles on which it was hoped to control planning. There was an alternative site with secure foundations near the river at Washington. Mr. J. E. Hodgkin, mining engineer, considered that the needs of the area could be met by extending Dunston power station (about 15 miles away). The Dean of Durham (Dr. C. A. Alington) described Durham as one of the most beautiful cities in England if not in Europe, and said that if it were proposed to erect a similar building at Oxford, Cambridge, Bath or Edinburgh there would be a national outcry.

Among those who gave evidence in opposition to the scheme on the final day, when the sitting lasted nine hours, was the Bishop of Durham (Dr. A. T. P. Williams) who expressed his deep concern for the economic prosperity of Durham county and its people and said he knew the importance of adequate electrical power. He found it hard to believe that an alternative site was beyond discovery.

Support of the scheme was expressed by Alderman J. W. Foster on behalf of Durham County Council.

Closing the inquiry, the chairman said that a decision would be given in due course.

Transformer Losses

Valuation and Capitalisation

ALTHOUGH transformer efficiency is generally high, the value of the energy lost within a transformer in five to ten years can in certain cases equal the first cost of its installation. Therefore economic selection should take into account both the first cost as well as inherent power losses. Practical procedure for doing so, which is intended to be both simple and comprehensive, is outlined in the paper prepared by MR. W. SZWANDER (Warsaw) for the Transmission Section of the Institution of Electrical Engineers.

The author's object is to introduce some degree of uniformity into the calculations that determine the choice. He considers two aspects of the problem: first the comparison of total annual operating costs and, secondly, the less simple evaluation of investment cost including the capitalised value of the transformer losses, which introduces complications when dealing with design to satisfy individual economic requirements.

The first method is the more popular and appears to be the more comprehensive; it will furnish accurate results if the values of the equation constants are properly chosen. The conclusion about the second method is that, to be economic, the loss ratio chosen must be such as to ensure that the annual costs of the iron and copper losses will be the same, so that the total annual cost of the losses shall be about 2·5 times the total annual capital cost.

The formulæ developed by the author are supplemented with information on the selection of correct values for the requisite equation constants. A statistical survey is included of methods used hitherto by different buyers of transformers for capitalisation of losses and, finally, approximate values of the formulæ coefficients for such loss capitalisation are suggested, which may be utilised in the absence of more precise information.

Industry's Future

Scope for Improvement

THE keynote of MAJOR-GENERAL K. C. APPLEYARD's presidential address to the Junior Institution of Engineers last Saturday was the need for improved methods in industry. He felt it was both wrong and dangerous to mix up a proper respect and admiration for the technical achievements of our forebears with unnecessary admiration and loyalty to their manufacturing methods and techniques. The competitive world moved ever faster, and unless we were moved by that "divine discontent" which brought progress others would pass us by. Our older industries remained old in their outlook and methods; the newer ones which depended on them were thus handicapped.

In the future we should have to use our own natural resources to the maximum before importing, and exchange our surpluses for the things we must import to keep ourselves and our industries going. To do this efficiency must be our watchword. Mechanisation had a long way to go before we got sufficiently cheap coal, steel, transport and all the rest to enable us to place our engineering products in foreign markets on satisfactory terms. The choice lay between highest efficiency and low wages with a lower standard of living. General Appleyard asked: Were we satisfied with our present rail transport which had hardly improved in speed for fifty years? Did any mechanical or electrical reproduction of the human voice sound perfectly natural? Where were the tiny pocket receivers and transmitters operated by ourselves as we walked? The soldiers' "walkie-talkie" was evidence that they would be with us some day. He also spoke of the possibilities of harnessing the power from the sun, water and wind. We need never fear a lack of scope; what we had to guard against was lack of energy, lack of imagination and failure to grasp opportunities.

Transmission-Line Transients

Irish Centre Paper

MENTION of surges and transient phenomena is apt to call to mind complicated differential equations, whereas the object of the paper presented by MR. P. HARKIN (Dublin City engineer, Electricity Supply Board) in Dublin last month to the Irish Centre of the Institution of Electrical Engineers is to apply simple wave treatment in an almost non-mathematical manner to some circuit phenomena.

The author's endeavour is to formulate clear physical conceptions of the origin and behaviour of the transient effects most frequently encountered on transmission lines in order to help those not already familiar with the nature of travelling waves and, at the same time, provide an introduction to others wishing to enter the mathematical realm of treatment of this subject.

After defining circuit constants, wave velocity and reflection are explained with respect to both short-circuited and open lines. Since it appears that the voltage applied to the circuit will not "stay put," the author indicates how the potential difference may be removed by the usual process of earthing the line. He then differentiates between the actions of induced charges and direct lightning strokes, indicating the means by which wave-front steepness may be lessened and, finally, the manner in which line-surge arrestors are intended to function.

Moisture on Insulators

SOME of the effects of condensation of moisture from the atmosphere on to the surfaces of insulating substances are dealt with in a paper presented by MR. J. F. STIRLING to the North-Eastern and London Students' Sections of the Institution of Electrical Engineers.

The paper outlines the theory of condensation with the aid of formulæ and describes some experimental determinations which in the case of fibrous pressboard showed a rapid drop of surface resistance at the edges of the material (indicating rapid condensation of moisture) followed by a slow decline of volume resistance (indicating gradual infiltration of moisture into the interior); silk fabrics as well as glass-fibre silk are much superior. Other investigations have proved that the cracking of shellac surfaces and the powdering of mica by disintegration promotes condensation within cavities between the grains; hence the need to avoid brittleness that would tend to crack the surface and to keep the latter scrupulously free from dust.

ELECTRICITY SUPPLY

Site for New Glasgow Station. Norwich Raid Damage.

Barnard Castle.—POST-WAR LIGHTING.—The Urban District Council is to consider estimates by the North-Eastern Electric Supply Co., Ltd., for street lighting after the war.

Barnstaple.—ELECTRICITY SHOWROOMS AND OFFICES.—The Town Council has approved a recommendation of the Electricity Committee to acquire premises at 7, Cross Street, for £5,000, subject to the approval of the Electricity Commissioners, for the purpose of new showrooms and offices.

Billingham-on-Tees.—DOMESTIC APPARATUS.—The North-Eastern Electric Supply Co., Ltd., has submitted proposals to the Urban District Council for installing all-electric appliances in houses to be built at Billingham Junction after the war. Before coming to a decision the Council proposes to obtain the views of the tenants of other houses in which similar apparatus has been installed.

Birkenhead.—NAME OF POWER STATION.—The Electricity Committee has decided that the new power station to be erected on the banks of the River Mersey at Bromborough shall be called the Birkenhead station.

Bristol.—RENEWAL OF INSTALLATION.—The Visiting Committee of the Bristol Mental Hospital, Fishponds, has agreed to the re-wiring of the cinema hall, stage, projection room, and adjoining rooms at the hospital.

Caterham and Warlingham.—LIGHTING OFFER ACCEPTED.—The U.D.C. has decided to take advantage of the County of London Electric Supply Company's offer to provide fittings for "moonlighting" free of charge.

Chesterfield.—METER MAINTENANCE.—Owing to shortage of labour it has been found difficult to maintain meters properly. The Electricity Committee is making representations to the Electricity Commissioners pointing out the probable loss of revenue and waste of electricity owing to the inability of the Department to provide the man-power necessary to change defective meters in reasonable time.

Glasgow.—POWER STATION SITE.—The Clyde Navigation Trust on December 5th agreed to grant a site to Glasgow Corporation for the construction of an electricity generating station, to grant suitable wayleaves for cables, and to lease to the Central Electricity Board a site for a grid substation. At the same meeting the Trust approved schemes of development contained in a report by a special committee. These include the construction of a new riverside quay at an estimated cost of £2,235,000, towards which a substantial grant is to be sought.

Isle of Ely.—ELECTRIC KITCHENS.—The County Education Committee is to provide electric kitchens at Queen's School, Wisbech (£5,136), Ramnoth Road Boys' School, Wisbech (£5,212) and Whittlesey Schools (£6,492).

Leeds.—POWER STATION CHIMNEYS.—A proposed amendment of the original plans for extensions at the Kirkstall generating station was recently reported to the Reconstruction Committee. The Electricity Commissioners have suggested that, to avoid a possible grit nuisance, a 300-ft. brick chimney should be constructed in connection with the last section of the boiler house instead of three 200-ft. steel chimneys.

Manchester.—MODERNISATION OF LIGHTING SYSTEM.—The Electricity Committee has recommended the City Council to consider a five-year programme for changing over to electric lighting in all the streets of the city in order to meet modern needs and in view of the great advances which have been made in the science of illumination.

New Romney.—LIGHTING CHANGE.—Before the war the town was lighted by gas, but the Council has now decided, by a majority, to adopt electric lighting in future. Tenders were considered from the New Romney Gas Co. and the Folkestone Electricity Supply Co. Councillor L. A. Kirkland said that electricity was not standing still and if they chose electric lighting they would be able to take advantage of new ideas. With gas, they would go back to where they were 25 years ago.

Norwich.—RESTORING SUPPLIES AFTER RAIDS.—The story of how electricity supplies were restored after severe air raids on the city is related in a report which has just been issued by the city electrical engineer (Mr. J. A. Sumner). On the night of the first big raid 42 main electric cables were severed or badly damaged, cutting off the supply to 20,000 consumers. Within 16 hours 18,000 of those services had been restored and three days later only 500 places remained without supply, and many of those were affected by streets being closed because of unexploded bombs. Experience gained on that occasion enabled even quicker repairs to be carried out after later raids. During five years of war the direct material loss suffered by the Electricity Department has amounted to £47,000, but consequential losses have been much greater.

Northern Ireland.—EXPORT TO EIRE.—At a meeting of the Belfast City Council recently Councillor J. Holland referred to a minute of the Electricity Committee which recorded that since the last meeting coal stocks had fallen by over 4,000 tons. Yet Northern Ireland had sold 1,215,000 kWh, representing 1,000 tons of coal, to Eire in the year ended March 31st last. That was a peculiar state of affairs.

Councillor A. Scott, chairman of the Electricity Committee, explained that there was a connection with Eire at Newry at the time of the "blitz" and there was one at Lifford. He was all for reciprocity, but when they were using 1,000 tons of coal which came to Ulster to supply places outside the Province, there was some inconsistency. They had, he said, been fighting strenuously to get stocks up to safety level in Belfast.

An official of the Electricity Board told Press representatives that when there was danger from air raids a proposal was put before the Electricity Supply Board of Eire for the provision of a supply to Northern Ireland in case of emergency. The E.S.B. pressed for some reciprocal arrangement in order to get the authorities in the South to agree and asked that supplies

be granted for use in County Donegal. It was a matter of mutual assistance, and although Northern Ireland did not in fact need supplies from Eire it might have happened that they would have been glad of them. The arrangement was not one-sided.

Plympton St. Mary.—EXTENSION OF POWERS.—The Rural District Council is applying to Parliament for leave to introduce a Bill for the extension of the Council's powers in respect of ts water and electricity undertakings, and for other purposes.

Salisbury.—REDUCED "UNIT" CHARGE.—The Salisbury Electric Light & Supply Co., Ltd., is reducing the "unit" charge under its standard domestic and business two-part tariffs from 1d. to ¾d.

Sheffield.—LARGE DEFICIT EXPECTED.—The Electricity Committee estimates that there will be a debit balance of £182,280 on the current year's operations of the undertaking, and that next year the deficiency will rise to £296,070.

POWER STATION EXTENSION. — The Finance Committee has approved additional capital expenditure of £548,026 in connection with the provision of plant for the Neepsend extension.

South Shields.—NEW BILL.—The Corporation has applied for leave to introduce a Bill for the purposes, *inter alia*, of conferring further powers on the Corporation with respect to the running of trolley vehicles and in connection with the electricity undertaking. Copies of the Bill (4s. each) may be obtained from the Town Clerk, South Shields, or the Parliamentary agents, Lewin Gregory Torr Durnford & Co., 2, Millbank House, Westminster, S.W.1.

Warrington. — CHARGES LEVELLED. — Representations having been made by Lymm U.D.C. against the additional charge of 10 per cent. made to electricity consumers in its area, the Corporation Electricity Committee has decided that the additional charge shall be abolished throughout the supply area.

Overseas

Eire.—NEW ELECTRICITY BILL.—Our Dublin Correspondent writes :—The Bill for the amendment and extension of the Electricity Supply Acts was introduced into the Dail on the eve of its adjournment for the Christmas holidays. At the time of writing the text is not yet available. The measure based on the recently published report of the Electricity Supply Board, provides for the generation of hydraulic power derived from rivers other than the Liffey and Shannon which are already harnessed. The River Erne is one of those whose inclusion is envisaged. As this river touches Northern Ireland territory at several points the co-operation of the Ulster Government may be needed to a certain extent for the realisation of the new schemes. The E.S.B. has already obtained powers to construct peat-fuelled stations by an Act of 1942. In the new Bill provision is also made for grants for rural electrification.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.*2.

AUTOMATIC Signal Corporation.—"Electrical apparatus for counting passing objects." 2997/41. March 30th, 1940. (565670.)

Automatic Telephone & Electric Co., Ltd.—"Telephone systems." 7685/43. August 6th, 1942. (565654.) "Telephone systems." 17/44. August 6th, 1942. (Divided out of 565654.) (565665.)

Birmingham Electric Furnaces, Ltd., and R. J. Lean.—"Tripping device for an electric switch." 7949. May 19th, 1943. (565761.)

A. H. Brackensey and Franco-British Electrical Co., Ltd.—"Highway direction and like signs." 8061. May 20th, 1943. (565715.)

British Thomson-Houston Co., Ltd.—Transformer tap-changing apparatus." 5919/43. April 16th, 1942. (565650.)

E. I. Du Pont de Nemours & Co.—"Electrolytic process for stripping copper deposits and for simultaneously plating articles with the metal." 7705/43. May 18th, 1942. (565709.)

General Cable Corporation. — "Insulated electric conductor." 16050/41. December 14th, 1940. (565744.)

General Electric Co., Ltd., and L. A. Archibald.—"Fittings for electric lamps." 13926. October 29th, 1941. (565695.)

General Electric Co., Ltd., and S. K. Lewer.—"Thermostatically controlled piezo-electric crystals." 12843. August 9th, 1943. (565691.)

B. G. Horstmann.—"Electrical follow up mechanism." 7969. May 19th, 1943. (565657.)

Jack & Heintz, Inc.—"Armature construction for dynamo-electric machines." 3996/43. March 11th, 1942. (565732.)

Kolster-Brandes, Ltd., R. W. Cundy and E. P. Wethey.—"Locking devices for rotary control shafts." 7812. May 17th, 1943. (565738.)

Marconi's Wireless Telegraph Co., Ltd.—"Modulated carrier wave signal receivers." 8077/43. May 1st, 1942. (565764.)

Philco Radio & Television Corporation.—"Automatic gain control for television receivers." 7891/43. June 13th, 1942. (565710.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—"Electrodes for electric discharge devices." 9467. June 11th, 1943. (565689.)

Standard Telephones & Cables, Ltd.—"Synchronisers for electric oscillators." 378/43. January 10th, 1942. (565703.)

Standard Telephones & Cables, Ltd., and W. R. Moscrip.—"Machinery for the manufacture of parts from fusible material." 8125. May 21st, 1943. (565766.) "Machinery for vacuum tube manufacture." 8126. May 21st, 1943. (565767.)

Standard Telephones & Cables, Ltd., and H. Wolfson. — "Cathode-ray tubes and visual indicating systems for apparatus including cathode-ray tubes." 8453. May 10th, 1940. (565694.)

J. Whitcher.—"Transmission of electric power." 4249. March 16th, 1943. (565734.)

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Aeronautical & General Instruments, Ltd.—At the annual meeting on December 8th, the chairman (Mr. W. McClelland, C.B., O.B.E., M.I.E.E.) said that specialised production for war purposes had been maintained at a high level during the past year. Active consideration was being given to the change-over to peace-time conditions. In this connection the company was favourably placed by its long association with the radio industry through Radio Instruments, Ltd. As a result of experience gained during the war new types of existing components would be made available together with additional products recently developed for broadcasting and television. The company was capable of producing a wide range of equipment from large radio transmitters and receivers to delicate electrical standards.

Tube Investments, Ltd., reports that the trading profits of its subsidiaries for the year ended July 9th last were £2,345,038, after providing for E.P.T., as compared with £2,271,185 in the preceding year. The year's net balance after providing for tax and other charges was £680,263 (against £565,106). The sum at the disposal of the holding company, including £251,641 brought in, is £1,075,689 (against £856,217, with £171,065 brought in). The final ordinary dividend is 12½ per cent. (against 10 per cent.), raising the total for the year from 20 to 22½ per cent. The dividend is at the same rate relatively on the liaison ordinary shares.

Burco, Ltd.—The trading profit for the past year fell from £32,208 to £17,838, due, the report states, to a reduction in the volume of work undertaken and the rate of profit permitted on munitions contracts. The net profit was £16,478 (against £23,071) to which is added £20,426 brought in. A sum of £8,000 is transferred to dividend equalisation reserve. The dividend is maintained at 15 per cent., but last year's 2½ per cent. bonus is not repeated; £21,029 is carried forward.

Calcutta Tramways Co., Ltd.—Last month it was reported that the Bengal Government had refused to sanction the purchase, in the manner proposed, of the Calcutta Tramways Company's undertaking by the Corporation. Subsequently it was stated that the Corporation had been legally advised that Government sanction was not necessary for the proposed purchase or operation of the tramways. The point was taken up by Sir Khaja Nazi Muddin, Chief Minister of the Government, speaking in the Bengal Assembly. He expressed his full agreement with those who felt that the tramways should be owned by the Corporation, but said that the proposal that the system should be run by the Corporation with the help of an agent was not advisable, nor was it a practical proposition either from the legal or financial points of view. If this were done the Corporation would be burdened with an annual deficit of £75,000. He said that so far no tender had been received.

A note in the *Financial Times* gives the total value of the assets which the Corporation seeks to purchase as Rs. 6,65,00,000 (approximately £4,987,500). It is stated that the Corporation is sending a deputation to the Chief Minister to discuss the proposed purchase and amendment of the Calcutta Municipal Act so as to give the Corporation power to raise a loan. It is believed that the Bengal Government favours a comprehensive Passenger Transport Board for Calcutta. Further action regarding the purchase of the tramways undertaking is likely to be postponed until this question is settled.

Turner & Newall, Ltd., report trading profits for the year ended September 30th amounting to £2,513,915, £196,886 less than in the previous year. After providing for depreciation, directors' fees, and taxation of the company and its subsidiaries, the net trading profits were £545,665 (£553,292). The general reserve again receives £100,000 and the Welfare Trust £10,000 (same). The final dividend is maintained at 8¾ per cent., again making 12½ per cent. The carry-forward is £112,847 (£99,457).

Joseph Lucas, Ltd., announce a trading profit of £340,426 for the past year, as compared with £329,811 for 1942-43. The allocations again include £100,000 to reserve, £50,000 for obsolescence and £15,000 to employees' funds. The ordinary dividend is maintained at 15 per cen t. by a final distribution of 12½ per cent.

S. Smith & Sons (England), Ltd., have declared a final dividend of 10½ per cent. on the preferred ordinary shares, again making 17½ per cent. for the year, and a dividend of 37½ per cent. (same) on the deferred ordinary shares. The net profit for the past year rose from £103,081 to £103,579.

McMichael Radio, Ltd., is paying 8 per cent. on its cumulative participating preference shares for the year to December 31st, 1940, and 2 per cent. for the first quarter of 1941.

The Barbados Electric Supply Corporation, Ltd., announces a trading profit of £25,895 for 1943-44 (against £26,160). The dividend is again at the rate of 5 per cent. and £1,822 (£2,481) is carried forward.

Oliver Pell Control, Ltd., is paying a half year's dividend arrears on the 6 per cent. participating cumulative preference shares for the six months ended June, 1942.

The Victoria Falls & Transvaal Power Co., Ltd., is paying an interim dividend of 4 per cent. (same).

Lisbon Electric Tramways, Ltd., are maintaining their interim dividend at 2½ per cent. free of tax.

The Electric & General Investment Co., Ltd., has declared an interim dividend of 3 per cent., as last year.

The London Electric & General Trust, Ltd., is again paying an interim dividend of 2 per cent.

J. & F. Stone Lighting & Radio, Ltd., are again paying a dividend of 6 per cent. for the past year

The Sun Electrical Co. Ltd., has again declared a dividend of 2½ per cent.

New Companies

Condaire, Ltd.—Private company. Registered November 20th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, refrigerators and cold storage machinery, heating and ventilating experts, electrical and other apparatus, fire alarm, escape and extinguisher manufacturers, etc. Directors: D. H. Jonathan and Mrs. D. Jonathan, both of 60, Luton Road, Anchorsholme, Blackpool. Registered office: 60, Luton Road, Anchorsholme, Blackpool.

Falkirk Auto Electrical Co., Ltd.—Private company. Registered in Edinburgh, November 30th. Capital, £10,000. Objects: To carry on the business of motor, mechanical and electrical engineers, etc. Directors: R. Henderson, 40, Slamanan Road, Falkirk; A. G. Turner, Belgrave, Milrig Road, Rutherglen; and L. F. Pardoe, Linville, King's Park Road, Glasgow. Registered office: High Pleasance, Falkirk.

Nickols Electrical, Ltd.—Private company. Registered November 30th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, electrical accumulators, batteries, dynamos, plant, fittings and accessories, wireless sets, etc. Directors: C. N. Coombe, Malew, Lower Hampton Road, Sunbury-on-Thames; and G. C. W. Nickols, 7, Farady Road, West Molesey. Registered office: 27, John Adam Street, Adelphi, W.C.2.

Taylor's Magneto Works, Ltd.—Private company. Registered November 30th. Capital, £100. Objects: To carry on the business of electrical, motor, radio and general engineers, etc. G. B. Wheeler, Lane End, Dunlop Avenue, Ainsdale, Southport, is the first director. Registered office: 13, King Street, Southport.

Dissolution of Partnership

Barratt & Thornton.—J. Barratt and C. Thornton, carrying on business under this title at 31, Dow Street, Chorlton-on-Medlock, Manchester, as electrical engineers, have dissolved partnership as from February 18th, 1944. The business is being continued by J. Barratt, who will attend to debts.

Companies' Returns

Statements of Capital

Llangollen & District Electric Light & Power Co., Ltd.—£6,000 in £1 shares (3,500 ordinary and 2,500 preference). Return dated June 7th. 2,113 shares taken up. £2,113 5s. paid, including 5s. paid on 1 share forfeited. Mortgages and charges: £1,500.

Woodstock Power Syndicate, Ltd.—Capital, £10,000 in £1 shares (all ordinary). Return dated June 1st (filed August 30th). 3,510 shares taken up. £3,510 paid. Mortgages and charges: £3,000.

L. Weekes (Luton), Ltd.—Capital, £10,000 in £1 shares (all ordinary). Return dated August 24th. All shares taken up. £10,000 considered as paid. Mortgages and charges: Nil.

W. T. Glover & Co., Ltd.—£500,000 in £1 shares (100,000 preference and 400,000 ordinary). Return dated June 15th. 100,000 preference and 344,550 ordinary shares taken up. £117,000 paid. £327,550 considered as paid. Mortgages and charges: Nil.

J. B. Saunders, Ltd.—Capital, £5,000 in £1 shares (4,000 ordinary and 1,000 preference). Return dated June 14th (filed July 27th). All shares taken up. £5,000 paid. Mortgages and charges: Nil.

Eastern Extension Australasia and China Telegraph Co., Ltd.—Capital, £4,000,000 in ordinary stock. Return dated July 13th. All stock taken up. £4,000,000 paid. Mortgages and charges: £752,400.

Aberayron & District Electricity Supply & Power Co. Ltd.—Capital, £12,500 in £1 shares (all ordinary). Return dated July 19th. 10,000 shares taken up. £7,002 paid. £2,998 considered as paid. Mortgages and charges: Nil.

Increase of Capital

The General Cable Manufacturing Co., Ltd., on December 7th approved an increase of the company's capital to £250,000 by the creation of 400,000 new 5s. ordinary shares. An alteration in the articles of association in connection with directors' remuneration was also approved. Mr. S. W. R. Pantling, the chairman, said that it was not proposed at present to issue any additional shares, but the further finance would be required for the development and expansion of the business which was growing very rapidly.

Mortgages and Charges

G. D. Radio Service, Ltd.—Assignment on November 20th, of proceeds of contracts, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Receiver Released

Harrison & Searle, Ltd.—G. Haring, of Queen's College Chambers, Paradise Street, Birmingham 1, ceased to act as receiver and manager on September 30th, 1944.

Liquidations

R. F. Hamilton & Co., Ltd.—Winding up voluntarily. Claims by January 18th to the liquidator, Mr. J. McPhail McKenzie, 109, Colmore Row, Birmingham.

Shirebrook Electric Supply Co., Ltd.—Meeting January 24th, at the Market Hotel, Shirebrook, to receive an account of the winding-up by the liquidator, Mr. J. Gadsby.

Bankruptcies

M. Tinner, electrical factor, trading as the Yorkshire Trading Co., 91, Porter Street, Hull. —Application for discharge to be heard on January 16th at the Guildhall, Alfred Gelder Street, Hull.

J. Harrison, electrical engineer, trading as Harrison & Son, 93, Princes Street, Southend-on-Sea.—Supplemental dividend of 2¾d. in the £, payable at the Official Receiver's Office, 42, Tavistock Square, W.C.1.

R. E. Pearcey, motor and electrical engineer, 105, Arthur Street, Withernsea, Yorks.—First and final dividend of 13s. 11½d. in the £, payable December 27th, at 1, Parliament Street, Hull.

STOCKS AND SHARES

TUESDAY EVENING.

FOR the time of year, Stock Exchange markets exhibit a good deal of vitality and attract a fair amount of business. Speculative investment has revived in a few domestic industrials, of which British Celanese shares happen to be the favourite for the time being. As a section, that for radio shares is amongst the most popular at present, a number of prices being better on the week. Front-rank industrial shares again went ahead. Attention to Home Railway stocks has shown a dwindling tendency.

Speculation in Calcutta Trams gave way to a quieter mood, upon the various conflicting developments which have occurred. Most of the company reports and accounts that are making their appearance tell of the good progress which is being made by industry; profits, however, being bitten into by taxation. The investor continues to demand from his Stock Exchange broker recommendations of such stocks and shares in the industrial groups as may be expected to show appreciation in price after the war.

Power Supply Expansion

The proposal to spend £90,000,000 in expansion of the electricity supply system is the motive power which turns more and more money toward the shares of the companies likely to be affected. British Insulated at 5¾ are ⅛ up: Callender's hold their previous gain at 5⅛ and Henley's at 27s. have risen 3d. General Electrics hardened to within a florin of £5. An advance of 4s. lifted Johnson & Phillips to 78s. At 73s. 3d., Hopkinsons are 1s. 6d. up and Telegraph Condensers rose ⅛ to 25s. Smaller improvements occurred in Associated Electrical Industries, 57s. 6d., Greenwood & Batley, 17s. 6d., Burco 16s. 6d., Power Securities, 29s. 6d. General Cable 5s. shares rose 1s. to 17s. The necessary resolutions for increasing the company's capital were duly passed at last Thursday's meeting. Laurence, Scott hardened to 13s. 6d. Ferranti 7 per cent. preference at 31s. 3d. were unaffected by the satisfactory report. The ordinary shares are privately held.

Electricity Supply Shares

Not a change in price has to be recorded in the Home electricity supply group. It is hoped that the companies will be able to supply informatory details in their next reports and accounts. Such information from utility companies has, of course, been banned for security reasons during the war years, but the restriction is now relaxed. In the Overseas list, Montreal Power dollar shares are 2½ higher at 25. Victoria Falls ordinary fell back 9d. to 88s. 9d. The company has declared the usual 4 per cent. interim dividend on the ordinary shares. Tokyo sixes are a point lower at 25, on the American aerial attacks upon Japan.

Crompton Parkinson

Crompton Parkinson has done so well of late years that hopefulness was inclined to look for an increase in the dividend and bonus, over and above the 22½ per cent. paid last year, which went against an annual 20 per cent. in the previous three years. The company, however, as announced in last week's issue, declared 22½ per cent. altogether, and the price of the shares remains at 33s. 6d., showing a return of £3 7s. 3d. per cent. at that price. The profit comes out very close indeed to that of the previous twelvemonth. Profits of the British Electric Transformer Company, controlled by Crompton Parkinson, were £24,600, a drop of about £12,400. The dividend of 9d. per share goes against 1s. 4½d. in the previous period. The British Electric Transformer ordinary shares are all held by the controlling company. The 5 per cent. preference are quoted at 22s. middle.

Joseph Lucas

Joseph Lucas ordinary shares are now quoted ex the final dividend at 82s. middle. The company paid 15 per cent. for the year ended August 7th last, and the yield at the present price is £3 13s. 2d. per cent. on the money. The company's balance sheet is exceptionally strong. The issued capital is £2,342,515 of which all but £247,000 is in ordinary shares of £1 each. These have received annual dividends of 15 per cent. for nine consecutive years and the price during that period has ranged from 39s. 6d., in 1940, to the present figure, the highest reached for many years. In 1930, Joseph Lucas acquired the electric lighting and starting and magneto branch of the business of S. Smith & Son (Motor Accessories), Ltd. Last year, the company acquired the share capital of Girling, Ltd., previously known as New Hudson, Ltd.

J. & F. Stone

J. & F. Stone Lighting & Radio, whose year ended on June 30th, has declared a first and final dividend of 6 per cent., being the same as that of a year ago. This followed four annual dividends of 5 per cent. In 1939 the company paid 10 per cent., and in 1936 12½ per cent. The company, now eleven years old, was formed to acquire the business of general merchants and dealers in lighting, heating and cooking appliances, wireless apparatus and accessories. In 1939, it acquired the undertaking of S. Grey & Co., Ltd., with 53 shops. The issued capital is £400,000 in ordinary shares of 5s. each and £160,370 in 6 per cent. preference shares of £1. The preference are redeemable by means of an annual redemption fund operating by

(*Continued on page* 871)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Dec. 12	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Ordinary					
Bournemouth and Poole	12½	12½	62/6	..	4 0 0
British Power and Light	7	7	33/–	..	4 4 10
City of London	7	5½	30/–	..	3 13 4
Clyde Valley	8	8	42/–	..	3 16 0
County of London	8	8	43/–	..	3 14 5
Edmundsons	6	6	31/–xd	+3d.	3 17 5
Elec.Dis.Yorkshire	9	9	45/6	..	3 19 6
Elec. Fin. and Securities	12½	13½	60/6	..	4 9 0
Elec. Supply Corporation	10	10	50/6	..	3 18 6
Lancs. Light and Power	7½	7½	37/–	..	4 1 1
Llanelly Elec.	6	6	26/6	..	4 10 7
Lond.Assoc.Electric	3	4	26/–	..	3 1 6
London Electric	6	6	30/6	..	3 18 8
Metropolitan E.S.	8	8	43/–	..	3 14 5
Midland Counties	8	8	41/6	..	3 17 0
Mid. Elec. Power	9	9	44/–	..	4 1 10
Newcastle Elec.	7	7	32/–	..	4 7 6
North Eastern Elec.	7	7	34/6	..	4 1 2
Northampton	10	10	50/–	..	4 0 0
Northmet Power	7	7	41/–	..	3 8 4
Richmond Elec.	6	6	26/–	..	4 12 4
Scottish Power	8	8	40/6	..	3 19 0
Southern Areas	5	5	23/–	..	4 7 0
South London	7	7	30/–	..	4 13 4
West Devon	5	5	24/–	..	4 3 4
West Glos.	4½	3½	25/–	..	2 16 0
Yorkshire Elec...	8	8	43/–	..	3 14 5
Public Boards					
Central Electricity :					
1955–75	5	5	115	..	4 7 0
1951–73	4½	4½	106	..	4 5 0
1963–93	3½	3½	104	..	3 7 4
1974–94	3½	3½	100½	..	3 4 8
London Elec.Trans.	2½	2½	98½	..	2 10 9
London & Home Counties 1955–75	4½	4½	112	..	4 0 4
Lond.Pass.Trans.Bd.					
A	4½	4½	121½	..	3 14 1
B	5	5	122½	..	4 1 8
C	3	3½	69	..	4 14 2
West Midlands					
J.E.A. 1948–68	5	5	106½	..	4 14 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	7/3	..	—
Calcutta Elec.	6*	6*	46/6	..	2 11 9
Cawnpore Elec...	10	7	41/3	..	3 7 9
East African Power	7	7	35/–	..	4 0 0
Jerusalem Elec...	7	5	29/–	..	3 9 0
Kalgoorlie (10/–)	5	5	10/6	..	4 15 3
Madras Elec.	Nil	4	32/6	..	2 9 4
Montreal Power	1½	1½	25	+2½	—
Nigerian Elec.	8	10	35/–	..	5 14 5
PalestineElec."A"	5*	5*	39/–	..	2 11 3
Perak Hydro-elec.	6	7	13/–	..	—
Tokyo Elec. 6%	6	6	25	–1	—
VictoriaFallsPower	15	15	88/9	–9d.	3 7 7
WhitehallInv.Pref.	—	6	26/–	..	4 12 4

Company	Dividend Previous	Dividend Last	Middle Price Dec. 12	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord.	15	15	61/–	..	4 18 4
Assoc. Brit. Eng.	6	7	57/6	..	2 8 9
Assoc. Elec. :					
Ord.	10	10	57/6	+6d.	3 9 5
Pref.	8	8	39/6	..	4 1 0
AutomaticTel.&El.	12½	12½	67/–	..	3 14 7
Babcock & Wilcox	11	11	53/–	..	4 3 0
British Aluminium	10	10	46/–	..	4 7 0
British Insul. Ord.	20	20	5½	+1/16	3 9 0
British Thermostat (5/–)	18½	18½	20/–	..	4 12 6
British Vac. Cleaner (5/–)	30	30	32/6	..	4 12 3
Brush Ord. (5/–)	8	9	11/–	..	4 1 9
Burco (5/–)	15	15	16/6	+6d.	4 11 0
Callender's	15	20	5 1/16	..	3 11 5
ChlorideElec.Storage	15	15	85/–	..	3 10 7
Christy Bros.	12½	17½	77/6	..	4 10 4
Cole, E. K. (5/–)	10	15	38/9	+1/3	1 18 8
Consolidated Signal	24	27½	6¾	..	4 1 6
Cossor, A. C. (5/–)	7½*	10*	28/9	+4/9	1 14 9
Crabtree (10/–)	17½	17½	43/–	..	4 1 4
Crompton Parkinson Ord. (5/–)	20	22½	33/6	..	3 7 3
De La Rue	35	40	9 1/16xd	+1/–	4 2 8
E.M.I. (10/–)	6	8	36/3	..	2 4 1
Elec. Construction	10	12½	58/9	..	4 5 0
Enfield Cable Ord.	12½	12½	63/6	–6d.	3 18 9
English Electric	10	10	55/–	..	3 12 8
Ensign Lamps (5/–)	25	15	21/3	..	3 10 8
Ericsson Tel. (5/–)	22*	20*	53/9	..	1 17 8
Ever Ready (5/–)	40	40	42/–	..	4 15 3
Falk Stadelmann	7½	7½	34/6	..	4 7 0
Ferranti Pref.	7	7	31/3	..	4 9 7
G.E.C. :					
Pref.	6½	6½	33/3	..	3 18 4
Ord.	17½	17½	98/–	+1/–	3 11 6
General Cable (5/–)	15	15	17/–	+1/–	4 8 3
Greenwood&Batley	15	15	47/6	+9d.	6 6 0
HallTelephone(10/–)	12½	12½	31/6	..	3 19 4
Henley's (5/–)	20	20	27/–	+3d.	3 14 0
4½% Pref.	4½	4½	24/–	..	3 15 0
Hopkinsons	15	17½	73/3	+1/6	4 15 9
India Rubber Pref.	5½	5½	23/–	..	4 15 9
Intl. Combustion	30	30	6½	..	4 12 4
Johnson & Phillips	15	15	78/–	+4/–	3 17 0
Lancashire Dynamo	22½	22½	100/–	..	4 10 0
Laurence, Scott(5/–)	12½	12½	13/6	+3d.	4 12 7
London Elec. Wire	7½	7½	38/–	..	3 19 0
Mather & Platt	10	10	56/3	..	3 11 2
Metal Industries (B)	8	8½	50/–	..	3 8 0
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Mid. Elec. Mfg.	25	25	7½	..	3 10 3
Murex	20	20	5	..	4 0 0
Newman Ind. (2/–)	20	20	7/3	..	5 10 0
Philco (2/–)	—	—	15/–	+6d.	—
Power Securities	6	6	29/6	+6d.	4 1 4
Pye Deferred (5/–)	25	25	32/6	..	3 17 0
Ransome & Marles	20	20	87/6	..	4 11 4
Revo (10/–)	17½	17½	44/–	..	3 19 7
Reyrolle	12½	12½	71/3	..	3 10 3

(Continued on next page)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Dec. 12	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing (*Continued*)					
Siemens Ord. ..	7½	7½	36/3	..	4 2 9
Strand Elec. (5/-)	10	12½	12/-	..	5 4 2
Switchgear & Cowans (5/-) ..	20	20	20/9	..	4 16 7
T.C.C. (10/-) ..	5	7½	25/-	+½	3 0 0
T.C. & M. ..	10	10	56/-	..	3 11 6
TelephoneMfg.(5/-)	9	9	12/-	..	3 15 0
Thorn Elec. (5/-)	20	20	28/9	..	3 9 6
Tube Investments	20	22½	5½	..	4 8 9
Vactric (5/-) ..	Nil	22½	17/6	..	6 8 6
Veritys (5/-) ..	7½	7½	8/3	..	4 11 0
WalsallConduits(4/-)55	55		52/6	..	4 3 10
Ward & Goldstone (5/-)	20	20	30/6	..	3 5 8
WestinghouseBrake	12½	14	75/-	..	3 14 8
West, Allen (5/-)	7½	7½	8/9	..	4 5 9
Traction and Transport					
Anglo-Arg. Trans:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	8	..	—
Brit. Elec. Traction:					
Def. Ord. ..	45	45	1200	..	3 15 0
Pref. Ord. ..	8	8	190	..	4 4 3
Bristol Trams ..	10	10	57/-	..	3 10 2
Brazil Traction ..	1½	2	26½	..	7 9 7
Calcutta Trams	6½	7½	70/6	−2/-	2 2 10
Cape Elec. Trams	5	6	26/-xd	+7d.	4 12 4
Lancs. Transport	10	10	47/6	..	4 4 3
Southern Rly.:					
5% Prefd. ..	5	5	77½	+½	6 9 2
5% Pref. ..	5	5	119½	−1	4 3 8
T. Tilling ..	10	10	62/6	+6d.	3 4 0
West Riding ..	10	10	47/6	..	4 4 2
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref. ..	6	6	124	+1	4 16 7
Def.	1½	1½	30	..	5 0 0
Anglo-Portuguese	8	8	29/6	+1/6	5 8 6
Cable & Wireless:					
5½% Pref. ..	5½	5½	117	+½	4 14 0
Ord.	4	4	83	−½	4 16 5
CanadianMarconi$1	Nil	4cts.	9/6	+6d.	—
Globe Tel. & Tel.:					
Ord.	8½*	5*	39/6	..	2 10 8
Pref. ..	6	6	31/-	..	3 17 5
Great Northern Tel. (£10)	Nil	Nil	29	..	—
Inter.Tel. & Tel.	Nil	Nil	19	..	—
Marconi-Marine..	7½	7½	35/6	−1/-	4 4 6
Oriental Tel. Ord.	16	10	49/6	..	—
Telephone Props.	Nil	6	21/3	..	5 13 0
Tele. Rentals (5/-)	10	10	12/3	..	4 1 8

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page 869*)

purchase at or below 22s. 6d. per share or by drawings at the same price. The 5s. shares stand at 8s. 6d. and the preference are quoted 21s. 3d. In the black days of 1940, the ordinary fell to 1s., but, within the past decade, the price has been a little over 10s.

Telegraphs and Telephones

Cable & Wireless preference at 117 and the ordinary at 83 are respectively 10s. better and lower. The stocks are suggested as meriting inclusion amongst securities selected for post-war prospects. The argument runs that the switch-over from war to peace should be accomplished without dislocating or diminishing the Cable & Wireless operations. There might arise, however, discussions, with overseas interests, about rates and charges. Anglo-Portuguese Telephones are a firm spot at 29s. 6d. Anglo-American Telegraph preferred hardened to 124, and of the lower-priced shares, Canadian Marconis, at 9s. 6d., reflect a mild demand from speculative investors. Marconi Marines have gone back 1s. to 35s. 6d.

Cole and Cossor Boomlet

Something like enthusiasm has broken out in the market for radio and cinema shares. For some time past it will have been noticed that shares in this group have developed a hardening tendency. At the end of last week, a swift rise in Cossor shares lifted the price to 28s. 9d. : this served to draw interested attention to the group as whole. At the figure mentioned Cossor are 4s. 9d. up on the week. At the same time, E. K. Cole spurted to 38s. 9d., this putting up the price by 4s. 3d. Philco, which had been down to 14s., recovered to 15s. bid. E.M.I. shares, after being a dull market at 35s. 9d., rallied to 36s. 3d. McMichael Radio strengthened to 8s. 6d. under persistent support from buyers looking to the future.

Radio Prospects

The radio industry, which received some time ago bullish impetus from a speech of the Prime Minister, is assured of post-war prosperity and expansion. Clients ask which company is likely to benefit most from the rush that there will be after the war to buy sets, ordinary or television, or both. Probably it matters little which shares the prospective buyer chooses. One of the few companies whose shares have not participated to any great extent in the popularity of the market is Pye Radio. The 5s. deferred shares stand about 33s., giving a return of £3 16s. per cent. on the money on the basis of the 25 per cent. dividend that the shares have received annually for several years past. Here, it might be thought, lies scope for appreciation, for in comparison with Cossor or E.M.I., purely on a yield basis, Pye deferred are the cheaper.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—VICTORIA.—April 26th. Melbourne City Council. Supply and erection of electrostatic flue dust collecting equipment. Specification from City Electrical Engineer's Office (£1 1s.).

Burnley.—December 22nd. Electricity Department. E.h.v. ring main unit with provision for metering equipment. (See this issue.)

Eye.—December 18th. Borough Council. Supply and installation of a centrifugal borehole pump and vertical spindle electric motor with automatic control equipment. Lieut.-Col. W. H. Bateman, consulting engineer, Batheaston, Bath (deposit £1 1s.).

Fife.—December 20th. County Council (Catering Committee). Various works, including electrical, for central kitchen at Pittenweem. Schedules from C. R. Douglas & Son, surveyors, Dunfermline (£1 1s.).

Orders Placed

Blackburn.—Corporation Electricity Committee. Accepted. Conveyor belting for generating station (£503).—Tuck & Co. Switchgear at Wensley Street and Moorgate substations (£174).—A. Reyrolle & Co.

Blackpool.—Transport Committee. Accepted. Tram rails (150 tons) and fishplates (4 tons).—Dorman Long. Ten drums of trolley wire.—Thomas Bolton & Sons.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alloa.—Factory extensions for the Harland Engineering Co.; manager.

Ashington.—Municipal hall with theatre, library, etc.; G. Beatty, surveyor, U.D.C. offices, Ashington, Northumberland.

Birkenhead.—Development, Woodchurch estate; H. J. Rowse.

Birmingham.—Technical schools, Handsworth (£7,500) and Bordesley Green (£3,075); city engineer.

Blackpool.—Extensions to Baines' Grammar School; secretary.

Bolton.—Canteen, Union Road; Dart Mill, Ltd.

Rebuilding Grapes Inn, Blackburn Road; John Hamer.

Bradford.—Works additions; S. Ingham, textile machinery manufacturer, 15, Lower Ernest Street.

Broadheath.—Works additions; L. Fairclough, Ltd., building contractors, Chapel Street, Adlington, near Chorley.

Cumberland.—Maternity unit at Penrith; J. H. Haughan, county architect, 4, Alfred Street North, Carlisle.

Dumbartonshire.—Schools; architect, County Council, Dumbarton.

Durham.—New Union rooms for men and women and new St. Mary's College for Women at Durham University.

Elgin (Morayshire).—Houses (300) on Seafield estate after the war; burgh surveyor.

Halifax.—Reconstruction of Woodside swimming baths (£7,600); borough engineer.

Isle of Ely.—Maternity home, Wisbech; county architect.

Works additions, Lynn Road, Ely; F. Standen & Sons.

Isle of Wight.—Extensions, Leeson school, Ventnor (£3,490) and central kitchen, Steephill Castle, Ventnor (£2,790); county architect.

Matlock.—Extensions to Ernest Bailey Secondary School; secretary.

Montrose.—X-ray, massage, electrical and therapy departments at Infirmary (£4,000), subject to sanction by Ministry of Works; R. Pert & Sons, Ltd., architects, Montrose.

Newcastle (Staffs).—Transport depot, Talke Road; Adams & Edwards, architects, 3, Brook Street, Stoke-on-Trent.

Newcastle-on-Tyne.—Reinstatement of Dame Allan School, Royal Grammar School and Raby Street School; city property surveyor, Town Hall, Newcastle-on-Tyne.

North Riding.—Extensions, Claypenny Mental Colony (£8,000) and kitchen at Cayton Council School; county architect, County Hall, Northallerton.

Rotherham.—Central kitchen for school meals; borough architect.

Scarborough.—Indoor swimming baths at The Crescent; borough engineer.

Seaham (Co. Durham).—Bakery for Snowball & Dale; Marshall Tweedy & Bourn, Grainger House, Blackett Street, Newcastle-on-Tyne.

Sheffield.—Works additions, Clay Wheels Lane; Pickford Tool Co., Ltd., Crescent Works.

South Shields.—Conversion of premises, John Clay Street, to factory to be let to clothing firm (£2,000); acting borough engineer.

Staveley.—Demonstration houses; J. B. McGaw, surveyor, Council Offices, Staveley, near Chesterfield.

Swansea.—Rebuilding Missions to Seamen Institute (£15,000); Rt. Rev. W. Williamson, Bishop of Swansea and Brecon.

Wakefield.—Workshops (£1,680), Technical College; S. G. Wardley, city architect, Town Hall.

Wallasey.—Day school for defectives; borough engineer.

Warrington.—Dining hall at Hefferston Grange Sanatorium and cubicle block at Aiken Street Isolation Hospital; J. Y. Hughes, borough surveyor, Municipal Buildings.

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